

AVIATION WEEK

A MCGRAW-HILL
PUBLICATION

October 14, 1957 75 cents

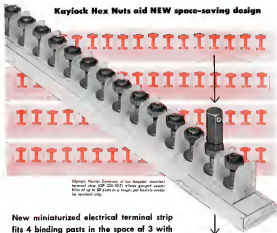
**Man Reaches 95 Mi.
Simulated Altitude
In Vacuum Chamber**



Avro Vulcan B Mk. II

TWA Analyzes Jet Costs, Operations

Keylock Hex Nuts aid NEW space-saving design



Olympic Flightline Company of Los Angeles' standard terminal strip (TOP) (20-107) allows greatest economy of up to 30 pins in a single pin location design for standard strip.

New miniaturized electrical terminal strip fits 4 binding posts in the space of 3 with

KEYLOCK

All model self-locking nuts

INTERNAL/external wrenching Hex Nuts

This new lightweight modular terminal strip was designed with KEYLOCK self-locking Hex Nuts in mind. The internal wrenching feature of the nut permits a close spaced assembly with compactness over before practice. The result is a saving of 33% in length and 10% in weight. Lockheed Aircraft Corp. in cooperation with Olympic Flightline Co. designed this new terminal strip for the aircraft and electronics industries.

INTERNAL/external wrenching—

- Reduces cable/terminal and terminal diameter
- Eliminates scratch damage to surrounding material
- Reduces weight and space

KEYLOCK Hex Nuts, available in steel or corrosion-resistant steel, conforms to all three Air Force-Navy standards: AN361, AN364, AN365, and the new low height National Aircraft Standard NAS307.



Circle 10 on Reader Service Card
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Circle 10 on Reader Service Card

What does it take to create a complete

Missile Weapon System?



WEAPON SYSTEM:

A definition

"A system composed of equipment, skills and techniques, the composite of which factors an instrument of combat, usually . . . among an air vehicle as its major operational element. The complete weapon system includes all related equipment, materials, services, and personnel required solely for the operation of the air vehicle . . . so that the instrument of combat becomes a self-sufficient unit of striking power within its intended operational environment."

—Quoted from Defense Department Regulations



GUIDANCE

—of the accuracy of ATRAC, Goodyear Aircraft Corporation designed, developed and produced this system for guiding American missiles.



SIGHTS

—extensive structural plans housing for a missile's electronic eyes. Goodyear Aircraft is a pioneer and leading producer of such housings.



RADES

—Goodyear Aircraft builds its performance software systems and large order quantities for early warning, missile guidance and tracking systems.



ARTIFACTS

—fabricated of the newest alloys by the most advanced techniques. Goodyear Aircraft has decades of light-metal experience in early processing, building thousands of complete systems and structures for today's jet aircraft and missiles.



ROCKETS

—to propel the missile beyond. Goodyear Aircraft builds more large-scale rockets than any other manufacturer, has one of the largest facilities in the nation.



GROUND SUPPORT EQUIPMENT

—to check the missile's design characteristics, the complete system's performance—sensors, actuators, launchers, a squadron's missiles. Goodyear Aircraft designs and builds this equipment, and has created today's foremost missile missile ground support system.



COMPUTERS AND FLIGHT SIMULATORS

—to check the missile's initial design characteristics and simulate its flight. Goodyear Aircraft builds GDSs, an early computer, and supplies flight simulators for the military services.



UNITED ENGINEERING

—to solve the technical complexities of creating a complete system. Goodyear Aircraft has a Weapon System Engineering expertise—specializes with a unified approach to, and complete familiarity with, the total problem.



PRODUCTION FACILITIES

—to tie together and produce the whole concept. Goodyear Aircraft maintains facilities in Akron, Ohio, and Lockfield Park, Arizona, where 32,000 skilled people work. In Key America First Is The Air.

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AIRCRAFT/MISSILES DIVISION

FAFNIR Torque Tube Type Aircraft Control Bearing with Self-Aligning Outer Ring

Design, assembly, and inspection of push-pull control systems are simplified considerably when Fafnir KP-BB Torque Tube Type Control Bearings are specified.

Developed to accommodate structural deflection, manufacturing errors, and differential expansion and contraction in high-speed aircraft, KP-BB bearings feature a self-aligning outer ring. This eliminates the need for extra parts to achieve and maintain correct bearing alignment in bearings. Thus these bearings make possible important savings in weight, weight, assembly time, and costs.

An adaptation of the AN202 KP-B series, Fafnir Self-Aligning Torque Tube Type Ball Bearings have the same high capacity as the rigid KP-B Type. The close fit between the self-aligning ring and the bearing provides the necessary rigidity for control systems. For detailed specifications, write The Fafnir Bearing Company, New Britain, Conn.



AVAILABLE SIZES AND DIMENSIONS

| Bearing Number - 00000 | B | D | W | H | A | C | G | To Contact (Std.) | Balls | | Weight Pounds - Approx. |
|------------------------|----------------------|------------------------------|-----------------------|-----------------------------|-------------------------------|-----------------|--------------|-------------------|-------|------|-------------------------|
| | Bore - 00000 - 00000 | Outside Dia. - 00000 - 00000 | Width - 00000 - 00000 | Hole to Gro - 00000 - 00000 | Shoulder Dia. - 00000 - 00000 | Groove | | | Nos. | Size | |
| | | | | | | Inner (Approx.) | Outer (Std.) | | | | |
| EP1000 | 1.0000 | 1.1875 | .400 | .375 | 1.141 | .004 | .004 | 1.000 | 23 | 3/32 | 18 |
| EP1100 | 1.1875 | 1.3750 | .400 | .375 | 1.304 | .004 | .004 | 1.1875 | 23 | 3/32 | 20 |
| EP1200 | 1.3750 | 1.5625 | .400 | .375 | 1.467 | .004 | .004 | 1.3750 | 23 | 3/32 | 22 |
| EP1300 | 1.5625 | 1.7500 | .400 | .375 | 1.630 | .004 | .004 | 1.5625 | 23 | 3/32 | 24 |
| EP1400 | 1.7500 | 1.9375 | .400 | .375 | 1.793 | .004 | .004 | 1.7500 | 23 | 3/32 | 26 |
| EP1500 | 1.9375 | 2.1250 | .400 | .375 | 1.956 | .004 | .004 | 1.9375 | 23 | 3/32 | 28 |
| EP1600 | 2.1250 | 2.3125 | .400 | .375 | 2.119 | .004 | .004 | 2.1250 | 23 | 3/32 | 30 |
| EP1700 | 2.3125 | 2.5000 | .400 | .375 | 2.282 | .004 | .004 | 2.3125 | 23 | 3/32 | 32 |
| EP1800 | 2.5000 | 2.6875 | .400 | .375 | 2.445 | .004 | .004 | 2.5000 | 23 | 3/32 | 34 |
| EP1900 | 2.6875 | 2.8750 | .400 | .375 | 2.608 | .004 | .004 | 2.6875 | 23 | 3/32 | 36 |
| EP2000 | 2.8750 | 3.0625 | .400 | .375 | 2.771 | .004 | .004 | 2.8750 | 23 | 3/32 | 38 |
| EP2100 | 3.0625 | 3.2500 | .400 | .375 | 2.934 | .004 | .004 | 3.0625 | 23 | 3/32 | 40 |
| EP2200 | 3.2500 | 3.4375 | .400 | .375 | 3.097 | .004 | .004 | 3.2500 | 23 | 3/32 | 42 |
| EP2300 | 3.4375 | 3.6250 | .400 | .375 | 3.260 | .004 | .004 | 3.4375 | 23 | 3/32 | 44 |
| EP2400 | 3.6250 | 3.8125 | .400 | .375 | 3.423 | .004 | .004 | 3.6250 | 23 | 3/32 | 46 |
| EP2500 | 3.8125 | 4.0000 | .400 | .375 | 3.586 | .004 | .004 | 3.8125 | 23 | 3/32 | 48 |

* 00000 - 00000
Bearings shown in this table are available in the following sizes:



FAFNIR AIRCRAFT BEARINGS

FIRST...at the turning points in aircraft design

AVIATION CALENDAR

- Oct. 16—Constant Speed Drive Development. ASEE, Engineers Club, Philadelphia, Pa.
- Oct. 15-16—Conference on Computers in Control. American Institute of Electrical Engineers, Chalfont (Haddon Hall Hotel), Allentown City, N. J.
- Oct. 16-18-1957 IRII Canadian Convention. American Building Exhibition, Toronto, Ont., Canada.
- Oct. 17-18-1957 Aeronautical Convention, The McGraw-Hill, New York City, N. Y.
- Oct. 17-18-National Conference in Industrial Hygiene. Including the 1st in low altitude. Hotel Sheraton, Chicago.
- Oct. 18-Some Aspects of the National Guided Missile Program, 1st or 2nd John S. Sells, Director, Meeting, American Rocket Society and Institute of the Aeronautical Sciences, Monticello, Va. (Hilton Hotel), N. Y. C.
- Oct. 20-21-American Hydrographic Society, Fourth Annual Meeting, Boston, Mass. (Hilton Hotel), Boston, Mass.
- Oct. 21-22-Canadian Association of Engineers, Institute of the Aeronautical Sciences, Meeting, Montreal, Canada.
- Oct. 21-22-Conference on New Developments in the Field of Power, American Society of Mechanical Engineers, American Hotel, Allentown, Pa.
- Oct. 21-22-1957 National Safety Conference, General Motors, Chicago.
- Oct. 22-Third World Conference for Engineers, North Long Meeting in Toronto, Ont., Canada.
- Oct. 24-25-Pan-American Association of Engineers, North Long Meeting in Toronto, Ont., Canada.
- Oct. 24-25-Computer Applications Symposium, American Institute of Electrical Engineers, North Long Meeting in Toronto, Ont., Canada.
- Oct. 25-26-Third Annual Meeting Association of the U. S. Army, Sheraton Park Hotel, Washington, D. C.

(Continued on page 6)



The torque tube shown above is designed to be self-aligning and will support the inner and outer rings in the case of a shock or vibration.

A hole in the center of the outer ring allows the torque tube to be inserted into the bearing.

The torque tube is also used in the torque tube bearing. The torque tube is inserted into the bearing and the bearing is inserted into the torque tube.



The torque tube shown above is designed to be self-aligning and will support the inner and outer rings in the case of a shock or vibration. The torque tube is also used in the torque tube bearing. The torque tube is inserted into the bearing and the bearing is inserted into the torque tube.



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AVIATION WEEK - OCTOBER 14, 1957

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IN ANY ATTITUDE
THE F-105



Striking skyward or racing along "on the deck" . . . able to intercept or retarget against an aggressor with powerful agility . . . the new Republic F-105 Thunderchief fighter-bomber brings to the United States Air Force a devastating weapon for defense.

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Push to operate,
release automatically

Pull to operate,
resets in opening
position until reset for
automatic release by
next full-circle push
operation



MODEL 454 SPDT, 3-400, 500
amps, 125/250 V.A.C., 70 W.D.C.
150 amps, 100 V.D.C., 10 amp
100 V.D.C., 10 amp, 100 V.D.C.
10 amp, 100 V.D.C., 10 amp, 100 V.D.C.
100 V.D.C. 10 amp, 100 V.D.C.
100 V.D.C. 10 amp, 100 V.D.C.



MODEL 458 SPDT, 3-400, 500
amps, 125/250 V.A.C., 70 W.D.C.
150 amps, 100 V.D.C., 10 amp
100 V.D.C., 10 amp, 100 V.D.C.
10 amp, 100 V.D.C., 10 amp, 100 V.D.C.
100 V.D.C. 10 amp, 100 V.D.C.
100 V.D.C. 10 amp, 100 V.D.C.



MODEL 456 SPDT, 3-400, 500
amps, 125/250 V.A.C., 70 W.D.C.
150 amps, 100 V.D.C., 10 amp
100 V.D.C., 10 amp, 100 V.D.C.
10 amp, 100 V.D.C., 10 amp, 100 V.D.C.
100 V.D.C. 10 amp, 100 V.D.C.
100 V.D.C. 10 amp, 100 V.D.C.



MODEL 458 SPDT, 3-400, 500
amps, 125/250 V.A.C., 70 W.D.C.
150 amps, 100 V.D.C., 10 amp
100 V.D.C., 10 amp, 100 V.D.C.
10 amp, 100 V.D.C., 10 amp, 100 V.D.C.
100 V.D.C. 10 amp, 100 V.D.C.
100 V.D.C. 10 amp, 100 V.D.C.



MODEL 458 SPDT, 3-400, 500
amps, 125/250 V.A.C., 70 W.D.C.
150 amps, 100 V.D.C., 10 amp
100 V.D.C., 10 amp, 100 V.D.C.
10 amp, 100 V.D.C., 10 amp, 100 V.D.C.
100 V.D.C. 10 amp, 100 V.D.C.
100 V.D.C. 10 amp, 100 V.D.C.



MODEL 458 SPDT, 3-400, 500
amps, 125/250 V.A.C., 70 W.D.C.
150 amps, 100 V.D.C., 10 amp
100 V.D.C., 10 amp, 100 V.D.C.
10 amp, 100 V.D.C., 10 amp, 100 V.D.C.
100 V.D.C. 10 amp, 100 V.D.C.
100 V.D.C. 10 amp, 100 V.D.C.



MODEL 458 SPDT, 3-400, 500
amps, 125/250 V.A.C., 70 W.D.C.
150 amps, 100 V.D.C., 10 amp
100 V.D.C., 10 amp, 100 V.D.C.
10 amp, 100 V.D.C., 10 amp, 100 V.D.C.
100 V.D.C. 10 amp, 100 V.D.C.
100 V.D.C. 10 amp, 100 V.D.C.

how to cut control costs

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tion.

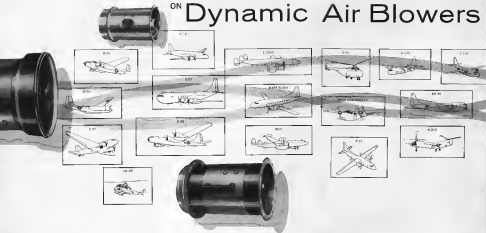


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HOW TO MOLD HEAT-STABLE LAMINATES WITH DOW CORNING SILICONE RESINS

Complex parts, such as hot air ducts and radomes, can be made easily with Dow Corning silicone laminating resins. Finished parts are lightweight, and retain high strength after prolonged aging at 500 F. Silicone-glass laminates have excellent wet electrical properties and low dielectric losses at radar frequencies. They can be drilled, machined, sawed or sanded. Here is the step-by-step procedure for vacuum bag molding of silicone-glass laminates.

STEP 1

Pre-impregnated glass cloth is hand laid out in a form. The form can be made of metal, plastic, or any heat-stable material. Where necessary, the cloth is tacked in place with a sealing iron. The pre-impregnated cloth has good drapability and can be used to make complex parts.



STEP 2

The lay-up is surrounded by bladder cloth, which allows even distribution of the vacuum.



STEP 3

The covered lay-up is placed in a PVA bag, and a vacuum drawn on the bag with a mechanical pump. The bag is then sealed, and the whole assembly placed in an oven. The part is cured through 350 F.

STEP 4

Following the initial cure, the bag and bladder cloth are removed. The part is then aftercured through 480 F, stressed, and finished. Complete operation is simple and economical.

For **FREE BOOKLET** describing applications and typical properties of silicone-glass laminates, **WRITE DEPT. 0932B**.

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MIDLAND, MICHIGAN

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Here is one more demonstration of Burroughs' capability and reliability in all facets of defense projects from research to field service. Areas of our proven competence include electronic computation and data processing, instrumentation, control systems and communications.

We invite further inquiries. Write, call or visit Burroughs Corporation, Defense Contract Organ-ization, Detroit 32, Michigan. Or Burroughs Defense District Offices: Forts # Dayton, Ohio; 2095 Linden Ave. • Fairfax, Calif.; 17021 Westing- house Blvd. • Westinghouse, D.C.; 1145 19th St. N.W.



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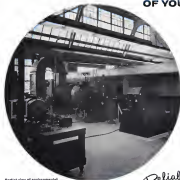




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Margin for Error . . . None!

You swing into your final approach. At precisely the right instant the Landing Signal Officer flags you to cut your power—and you're shorted! ⚡ Such skill and precise tolerance indicators of that which is required today in every phase of the aircraft industry. The bearings in modern jet turbines, for instance, must be held to extreme tolerances measured in millionths of an inch. That's why the leading jet turbine manufacturers specify Bower roller bearings first. Their exceptional high quality and meeting precision allow Bower bearings to stand under extreme turbine speeds and temperatures—that match the extreme speeds of today's jet aircraft—work a maximum of lubrication. ⚡ Whenever you produce, fit or use bearings, specify Bower! Choose from a complete line of tapered, straight and journal roller bearings for every field of transportation and industry.



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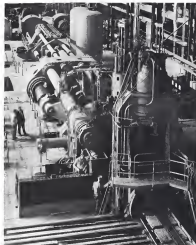
Rolls to hold their position indefinitely. Bore correct! Bearings are recommended wherever extreme loads and high speed operation are required. For more applications, a general catalog should be ordered. Bower and Bower is a Bower Corporation—no part.

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BOWER

ROLLER BEARINGS



HOW THE 13,200-TON
PRESS BOOSTS EXTRUSION
CAPACITY



FROM 11" TO 31"

STRUCTURAL SHAPES



FROM 9" TO 26"

STIFFENED SECTIONS



FROM 10" TO 24" O.D.

TUBING

DOW'S NEW EXTRUSION PRESS PACKS 13,200-TON PUNCH

Here's a whole new range of large magnesium extrusions:
24-inch O. D. tubing 28-inch I-Beams 80-foot-long sections

This mammoth press, newest addition to The Dow Chemical Company's rolling and extrusion mill at Midland, Illinois, is the world's largest magnesium extrusion facility. Its vastly increased capacities afford new opportunities for designers working with light metals. A wide variety of new magnesium applications for aircraft, marine, military and general industrial use are now possible and practical. In addition to extruding magnesium, the press is also available for large aluminum extrusions.

Here's how the big press will increase maximum dimensions of representative magnesium extrusions: Integrally

stiffened sections, from 9 to 26 inches wide. I-Beams from 14 to 31 inches high, round tubing from 10 to 24 inches outside diameter, and maximum lengths of 80 feet. A large number of shapes and forms can be produced, limited only by the design of the die through which the metal is extruded. Many complex shapes that formerly required separate operations can now be formed in one operation.

If your design calls for large magnesium or aluminum extrusions, contact the nearest Dow Sales Office or write to the new CHEMICAL COMPANY, Midland, Michigan, Department MA-1006A-1.

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EDITORIAL Sputnik in the Sky

The Soviet satellite (Russian name—Sputnik) now orbiting around the earth approximately 36 times every 24 hours at an average altitude of 400 miles offers irrefutable proof of another major Russian scientific achievement. Already the Sputnik is beginning to transmit new knowledge of outer space back to earth. There is little question that the successful Soviet satellite launching is a major advance in man's eventual conquest of space. All of the Russian scientists who participated in this venture deserve sincere and unreserved congratulations for their success.

Success of the Soviet Sputnik coming after a long chain of Russian triumphs in the development of atom-powered weapons ranging all the way from jet bombers, hydrogen fighters, both intermediate and intercontinental range ballistic missiles, and hydrogen warheads should be grounds for a major re-evaluation of the research, development and production programs of our own defense effort by top level political leaders.

Right to Know

We agree with Senators Styles Bridges and Leverett Saltonstall, distinguished Republican leaders, as well as with Senator Richard Russell and Stuart Symington, on the Democratic side, that such an investigation is also likely to lead to the future safety and prosperity of this nation and the rest of the free world. In fact, it is long overdue. We are glad to see again that it will develop as a bipartisan effort aimed at saving the best interests of the country rather than as ordinary partisan political skullduggery.

We believe the people of this country have a right to know the facts about the relative positions of the U. S. and the Soviet Union in this technological race which is perhaps the most significant single event of our times. They have the right to find out why a nation with our vastly superior scientific, economic and military potential is being at the very least equaled and perhaps being surpassed by a country that less than two decades ago couldn't even play in the same scientific ball park.

They also have a right to make the decision as to whether they want their government to maintain our current leadership of the free world regardless of the cost in dollars and cents or whether they wish to adequately subsidize this position in favor of enjoying a more easy pace of the hedonistic prosperity that now afflicts our country.

Major Issues

These are choices the citizens of this land must make for themselves. They are not decisions to be made arbitrarily by a clique of leaders in an ivory tower or on a golf course. To make these decisions properly, the people must have the plain and unvarnished facts.

There are three major areas that should be developed in the proposed Congressional investigation:

- **Dollar versus genuine military strength** as a yardstick of defense policy. During the past four years, there has

been a growing fear by the Eisenhower Administration that "we can't afford" adequate defense. The military force goals proposed by the administration have been so thoroughly under-financed that it has been obvious for several years that these goals would never actually be met. We need to know what a really adequate military structure would cost, how soon it could be developed and how effective it might be in meeting the threat not of today but of tomorrow.

- **Support of the defense effort** by the scientific community. There has been a steady deterioration of the relations between the Eisenhower Administration and the scientific community that are so vitally needed to fertilize and spark technological progress. The Robert Oppenheimer case, the policies of Atomic Energy Commission Chairman Lewis Strauss, the tragedy of Trevor Gardner in the Defense Department, the almost security clearance procedures of government agencies, the contemptuous attitude of former Defense Secretary Charles E. Wilson toward science and basic research, and President Eisenhower's widely quoted dismissal of scientists as "just another pressure group" have widened a dangerous gap between this group and their government. We need to take positive action to fertilize the field of basic research, get the scientists fully integrated into the defense program and provide them with the modest but long term financial support they need to achieve progress as fast as possible.

- **Rising costs and delayed results** caused by vicious destructive type of inter-service rivalry in the Pentagon. In addition to the corrosive effect of this and service rivalry, there is the straining effect on policy decisions and action of the growing bureaucracy in the Office of the Secretary of Defense. There is little doubt that, regardless of political system involved, the Soviets have equaled their defense science and technology effort on a more effective basis than the current situation that prevails in the Pentagon and the industry and science that now supports our defense effort.

Financial Bungling

Irreversible financial bungling in the Pentagon described in recent issues of *AVIATION WEEK* is sufficient to waste many precious months of productive effort by both science and industry. Not less, there is much doubt that the defense structure that has grown by bureaucratic accretions during the past five years without any real leadership from either the White House or the Secretary of Defense is grossly inadequate to deal with the problems involving the future survival of this country. A major change is long overdue.

So let's have a thorough, bipartisan investigation that will lay the facts on the line and provide the American people with an opportunity to decide their future fate. Maybe the Soviet Sputnik revolving in the sky will at last shake us out of the progressive complacency and flaccid leadership that has gripped us for too many years.

—Robert Hertz



**"Any way you look at it, Chuck...
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WHO'S WHERE

In the Front Office

Henry S. Ryan and J. Doyle DeWitt, American United Aircraft Corp., East Hartford, Conn.

Kenneth H. Gaudet, a director, Minister Processes Company, Inc., Kanto, N. H. & J. Backus, president, newly established Nucor Products, Inc., wholly owned subsidiary of North American Aviation, Inc., Santa Monica, Calif. Also J. S. Smith, vice president, Sereno and Sereno, an office of North American.

Donald M. Miller, executive vice president, Schenck Instruments Laboratory, Norwalk, N. Y.

Dr. Rufus F. Martin, Dr. Benton F. Miller and Milton E. Mule, vice president, The Ross-Woodbridge Corp., Los Angeles, Calif. Dr. Martin is assistant director General Motors Research Division, Dr. Miller is division communications director, Mr. Mule is group director Control Systems and System Division.

Walter G. Conrad, vice president and general manager, American Airlines de Mexico, S. A.

Honors and Elections

The Institute of Aeronautics and Astronautics will present the Emersonian Transport Trophy to the Boeing Aircraft Company to acknowledge the Boeing 737-400-100 transcontinental transport speed record, from Seattle to Baltimore, on March 11, 1957. In the future the trophy will be shared by the manufacturer of the aircraft record holding the speed record for a flight from the Pacific Coast to Washington, Japan.

Arthur E. Raymond, vice president engineering of Douglas Aircraft Company, has been selected to receive the 1957 David Graydon Medal "for notable achievement in the advancement of aeronautics."

Changes

Robert E. Chambers, chief development engineer, and Fenton E. Conway, chief product engineer, Consolidated Aircraft Systems Corp., Pasadena, Calif.

Arthur E. Smith, assistant general manager, and Perry W. Pratt, engineering manager, Pratt & Whitney Aircraft, division United Aircraft Corp., East Hartford, Conn.

Robert E. Bowditch, Jr., director of engineering, Lockheed Corp., Los Angeles, Calif. Richard E. Kargel, general manager, E-C-A-O Corporation of Canada, Ltd., London, Ontario.

J. R. Fowler, project engineer, Allport Instrument Company, Inc., Cambridge, Md.

Samuel Soule, director of engineering, Chicago Aerial Industries, Inc., Melrose Park, Ill.

Ralph Johnson, engineering research supervisor, Wright Electrical Instrument Corp., Newark, N. J.

Edward H. Melnick, manufacturing and quality control, Fisher & Porter Co., Madison, Wis.

INDUSTRY OBSERVER

Convair's Atlas intercontinental ballistic missile employs a cartridge that first and simultaneously develops and then provides for separating liquid propellant rocket sustainer stage. Missile also uses gas turbine generator designed by American Machine & Foundry Co., which is driven by waste's liquid oxygen and used to supply electrical power.

Douglas Three intermediate range ballistic missile is focused of three skin sections, each opening method of the aircraft's cross-section. Skin has rolled with pattern on its inside with ribs about 1/16 in. thick.

North American Aviation's Missile Development Division has formed a new space flight activity that will receive high priority support from main program. In the overall picture, however, MDD's working force has been increased to fit within the Defense Department's economy move and to allow it to continue operating as a division.

Douglas Guide air-to-air missile rockets are now being introduced to operational units of USAF's Air Defense Command.

Lockwood's L885 ship T33 turboprop engine is expected to be qualified for production before the end of the year, with production beginning in 1958. One application is in Grumman's CF-1 high performance observation aircraft, which carries five new air in Army/Navy competition for a STUC-type vehicle (AW May 21, p. 23).

Production efficiencies and improved learning curve in fabrication have enabled Piper Aircraft to cut maximum in production of the Apache light aircraft by about 25% since the serial models were rolled out. Piper estimates that, without this saving, current line Apache would not be appearing until 1958. Present cost is \$55,000. Mismanagement of conditions high-level production man also have been an important factor in maintaining the lower price. Originally, Piper thought it would take about five years to sell 1,000 Apaches, but it has sold more than that in three years.

Pratt & Whitney T34 turboprop engines powering VC-97B in reliability study of engines and associated systems tested and 52 instances of 10 engine failure scheduled. During the tests, there were only five delays for maintenance. Of these, only one was associated with the powerplant. Pilots who have flown the aircraft report that on cold days they have achieved rates of climb of 6,650 fpm immediately after takeoff at gross weights of 170,000 lb., reached 11,000 ft. in two min., 16 sec.

Douglas Helicopters hopes to attract the military in a proposal to equip a Sikorsky S-55 with the Douglas rotor head. Douglas says concerns, which would cost an estimated \$750,000 with the Army leaving the major share, would substantially reduce vibration.

Chesapeake is now producing the MG-19 Forster, Russia's 900 mph fighter. Earlier MG-17 is being produced under Russian license in Chesapeake, Chesapeake, China and Poland.

Allison is now producing approximately 35 T36 turboprop engines for the military each month; production capability is 100 per month. As of last month, Allison had produced a total of 1,180 T36s for the military, with the major portion of the output going into the Lockheed C-119 Riverhawk transport, of which 115 have been delivered. Allison also now has orders for approximately 700 civil versions of the engine, the 508D-13, from commercial operators for airlines and business aircraft.

Douglas C-119 turboprop transport is scheduled to begin regular logistics support operations from the Alaskan coast in April, 1958. C-119 will base at Davis, Del., now has done C-119s, expects to get its fourth in the next future. It will have 16 of the aircraft at full strength.



Ski-Jump with Jet Assist

A new version of the Fairchild C-123 is now flying with the USAF. Its wheel-less combination gear enables it to operate from ice or snow-covered fields as effectively as from unpaved dirt strips.

Takeoff performance shoots up with the addition of a Puschid J46 jet engine at each wing tip. Substantial increases in payload have become possible—takeoff and landing weights over 60,000 lbs. have been achieved and will become routine.

The ski-and-jet C-123 is typical of the versatile development and the potential Puschid builds into its aircraft.

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Washington Roundup

Space Flight Regained

One accomplishment of the Russian satellite launchings in the apparent absence of a USAF order forbidding space flight is that, word in the Soviet press, Soviet space flights on U.S. capabilities in the rocket field following the Soviet satellite launching was forced despite a July 29 directive which banned even stories describing some USAF research and development in efforts in "space flight." The order reported last month at headquarters, Department of Defense and congressional levels, and reported resistance of reaction of space, space technology and space research.

"No statement can be made," and the new-outdated order, "which might in any way cause the national media to describe the Air Force projects in efforts to fly in the moon."

Investigators

Sen. Evan Kefauver (D-Tenn.) may become the dominant personality during the Senate Subcommittee's investigation of the U.S.S. missile and guided missile program. Kefauver is the second ranking Democrat. Sen. Lyndon Johnson (D-Tex.), chairman of the subcommittee, is generally prohibited from active participation in committee business because of his duties in majority leader. Other senators on the subcommittee are John Stennis (D-Miss.) Stuart Symington (D-Mo.), Styles Bridges (R-N.H.), Everett Dirksen (R-Ill.) and Ralph Yarber (R-Vt.).

Partial Victory

Sharp disagreement still exists between the military and Civil Aeronautics Administration over which of two types of current lighting systems is best suited for landing under less visibility conditions. Following a series of CAA tests at Andrews AFB near Washington (AWT April 11, p. 99) with both narrow-gate and low-sloped fluorescent floodlight systems, the CAA strongly endorsed the latter. Aviation, on the other hand, held that the narrow-gate method was more adequate.

Industry contends that the fluorescent units would be less costly to install on presently established runways but does not agree with CAA's contention that, under the narrow-gate system, the pattern of light distorted when viewed deviate from the runway threshold.

As a result, CAA will have to industry's wishes and authorize installation of wide-beam low-sloped floodlights in a narrow-gate pattern on the new runway at New York International Airport. However, the fluorescent floodlighting system will be installed at the Washington National Airport so that tests and studies of both systems can be continued.

McElroy: A Bow to Science

Ned H. McElroy, who took office last week as Secretary of Defense, just as early how to the world of science. "I am conditioned," and the former president of Princeton & General's wife expressed to feel their need to support of scientific training in high-grade scientists. "I would not be on the side of my mother," McElroy's remarks were interpreted as indicating a sharp contrast with the attitude of his predecessor, Charles E. Wilson. Wilson was inclined to some research projects, particu-

larly of the speculative type that could boast of no immediate application to improved weapon systems.

'Snail's-Pace' Bilateral

Indications are that the U.S. Basic Air transport agreement now under discussion will become one of the most carefully negotiated bilateral in history because of recent changes of State Department "policies." Talks are progressing at a snail's pace with considerable time being spent in studying each phase. Discussions of more exchanges may still be a long way off.

Changing Times

National Missile Industry Conference, later called the National Rocket and Missile Industries Assn., has been chartered again. Its new names—the Assn. of Missile & Rocket Industries or AMRI. Knud K. Hoyt, acting secretary and spokesman for the group, says there is real need for the organization to provide a single point of contact between the services and the industry. "an old party" including "the makers of missile bodies."

Second meeting of AMRI will be held in Washington next week.

Rate Progress

International Air Transport Assn. traffic conference which opened here on Sept. 24 is expected to end late this week, although agreement has not yet been reached on the controversial third-class fare issue.

Since strong opposition of airlines has strongly supported the presentation of a two-tier fare level, progress toward a settlement of the Lomé problem of introducing a third level on North Atlantic routes has been slow. However, observers feel that, once differences on conditions under which the rates should be applied are worked out, the conference will approve the proposed three-level fare structure.

Some airlines have been worried that the third-class rates will eventually spill over into the moderate rates and other rates to destroy the basic fare structure of IATA.

The conference is studying the possibility of even basing the rate structure in order to strengthen and expedite revenue across on international routes.

Existing rules governing charter operations have also been the center of much debate. Problems is due to a basic conflict in philosophy with one group of carriers supporting rigid charter regulations to protect the base structure and another advocating more liberal rules to provide greater freedom in meeting new IATA competition.

Protest by American

American Airlines, on a petition to the Civil Aeronautics Board, has protested the proposed use of stopovers by Trans World Airlines on its Transcontinental routes. It argues that such stopovers American's petition claims that the proposed service would be comparable to TWA's deluxe transcontinental service for which there is a 333 degree and above first class fare. American wants CAB to either reject TWA's file a bill to cover the extent of or take steps to prevent its operation. —Washington staff

USAF Pushes Pied Piper Space Vehicle

Success of Soviet satellite will give new impetus to Lockheed project for reconnaissance satellite.

Washington-Soviet satellite launching will spur research and development efforts on advanced U. S. type vehicles including Lockheed Aircraft Corp's Pied Piper project. Pied Piper, sponsored by USAF, is an earth-orbiting reconnaissance satellite. A later version could be manned.

Russia is working on at least one project similar to Lockheed's Popular nickname for Pied Piper is Big Brother. Weapon system number is WS 117 L. Lockheed calls the project ARS for Advanced Reconnaissance Satellite.

Aerobionics Systems Inc. also is conducting studies, along lines similar to Pied Piper (AW July 22, p. 51), using its own and Air Force funds. Rand Corp., supported chiefly by Air Force research funds, has pushed work

on such satellites for the last 10 years. Other agencies also have given for advanced satellites, including manned vehicles.

Pied Piper dates back to early 1958 when an airborne-reconnaissance team headed by Lockheed won a competitive agreement over three other teams. Columbia Broadcasting System is probably Lockheed's mainstay, with Eastern Kodak as an associate participant.

Original investment in Pied Piper was \$4 million. This later was estimated to \$12 million for the first year. Satellite for WS 117 L would carry telescopic, photographic cameras, infrared spectra of radar scanner system.

Scientific Laboratories has built a one-ton model, awarded about three months ago to Rome Air Development Center, for ground handling studies in

connection with Pied Piper. Amount is approximately \$140,000.

Its work is to determine cognate events and accessories needed for interpretation and processing of data received from the satellite and construction of large mosaic or map.

The belief is that Pied Piper could not be ready in the near-term unless before 1960 unless a tremendous effort is placed behind it. Manned version, even on an accelerated schedule, is dated to 1965.

Manned vehicle would mean its orbit for perhaps a month. Biggest problem for a manned satellite probably is still recovery.

Launching vehicle for the reconnaissance satellite probably will be a three or four-stage liquid rocket system, with North American Aviation Inc. and Aerojet General Corp. as the most likely candidate manufacturers.

Approximately 500 to 1,000 lb. thrust will be required for one lb. of satellite weight.

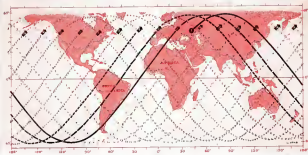
Orbit for unmanned Pied Piper would be between 100 and 1,000 mi. Lower orbits, better for reconnaissance work, are more than the steepness of climb angle could be done at.

When satellites move from the use of satellites of geographical reconnaissance data to earth reconnaissance, satellite legality will become a problem. Unless they are launched in a cooperative effort such as the International Geophysical Year, or with prior agreement among countries, effectively illegal reconnaissance probably could be used to bring them down.

Other problems include:

- Data transfer from satellite to earth. "Interim" taken by satellite means must be changed from the use of radio to electronic signals which satellite transmitter for signal to a ground station, where data would be put into one transmitter ship from a recorded on film or magnetic tape.
- Reliability of the satellite on its own. It will have to be oriented to keep its camera, infrared spectrometer, radar system at whatever pointing in the right direction. This will require power and add to complexity of equipment.
- Recovery. In addition to possibility that satellite could be shot down, repair might possibly be as practical or feasible as recovery.

Nevertheless, the ARS satellite is not considered a particularly difficult project, but more a question of adequate research and development funds and time. Possibilities of power to put the satellite into orbit and reliability of the equipment it will carry can be overcome with sufficient resources.



APPROXIMATE path of Soviet satellite around the earth. As satellite circles earth, north is rotating east. Satellite moves within bounds of 55 deg. north lat. and 65 deg. south lat. Arrows indicate direction of orbit.

Russian Satellite Transmits Some Data

Washington—First Russian satellite, weighing eight times as much as U. S. satellite will and launched into a more difficult orbit, contained at least crude information in addition to its radio transmission.

Naval 6.1 sec. duration of the radio signal was increased or decreased to a desired frequency changes of 50C or more.

Sputnik weighed 104.3 lb., measured 25 in. in diameter, had two antennas and was made of aluminum alloy. It was filled with antennas which, according to the Soviet newspaper Pravda, was "probably connected during the flight."

Satellite instrumentation

Earlier Russian statements and the satellite contained an earth-to-satellite radio transmitter and battery. Only one transmitter with U. S. satellite synchronization used, and the weight figure could easily have been that high if communication between were used. But none of them derived from the language initial statements that the satellite contained only radio and batteries and that signals were not coded.

Later Russian official statements spoke of "all the instruments" and said the satellite "has high sensitive elements which also the radio frequencies of the signals and the correlation between their

distances and information as soon as the temperature is other parameters of the satellite change."

Radio Moscow said the satellite allowed observations of changes in "absolute intensity of the energy of the electro-magnetic pole."

Protective nose cone and final third stage of "an extremely designed carrier rocket" also added, the Russians said. That would give a beam for comparison of speeds of orbit of each, from which drag might be calculated.

Pravda said "an extremely accurate and effective system of automatic control was designed for the rocket to ensure the satellite's designated trajectory necessary to take satellite to its orbit."

In language similar to the recent Russian announcement of a successful intercontinental ballistic missile flight, statements on the satellite launch and successful orbit of the goal "has fully confirmed the correctness of the calculations and basic technical solutions made in designing the carrier rocket and satellite."

Russians had given only advance notice of its firing place (AW June 17, p. 25). Last June 1, Pravda reported an interview with the president of the Soviet Academy of Sciences, stating that a "great breakthrough" in the satellite race was imminent.

Launch was made at 5:05 p.m. EDT on Oct. 4 at an angle of 55 degrees north of the equator. Russians said they came within one mile of it. Highest altitude reached in slightly elliptical orbit was about 680 mi., Pravda said. Time for one revolution averaged about 96.1 min.

Launching site

Launching site probably was north of the Caspian Sea at the site frequently used for intercontinental range ballistic missile flights.

U. S. experts estimated weight of a rocket necessary to carry a 194.3 lb. satellite to 550 mi. at between 200,000 and 300,000 lb. They considered this the most significant factor in the Russian achievement and speculated that a modified ICBM booster formed the first stage of the launch vehicle.

Pravda reported that later reconnaissance satellites would be fired and said "the Soviet Union will also launch a satellite having animals as passengers for the purpose of studying the behavior of living organisms during cosmic flight."

A Radio Moscow report stated that the first and second satellites would follow, and beyond that would come exploration of the planets.



Russians Fly VTOL Vehicle

Soviet VTOL is hoped by Russians to be derivative of passenger vehicle. Outgoing appears to be control type. No actual stable orbiting use of vehicle possible.

Impact of Russian Satellite To Boost U.S. Research Effort

By Evert Clark

Washington—Impact of Soviet satellite nations, taken as a series of an aggressive Russian technological advance, already has caused the status of satellite research and development from its lowest point in years.

Although the U. S. satellite satellite approach will not be accelerated, observers here agree that the Russian leadership will receive a stimulus to research and development programs that will help considerably to increase the adverse effects of budget cuts. Defense Secretary Neil McElroy, who took office in a time that the Soviet satellite was placed in its orbit, said at his first press conference last week that "Russian satellite programs have made it more important to us to go on and forward" in U. S. programs.

Although "we aren't thinking in terms of such greater defense expenditures, McElroy said, there probably will be an increase in future, more near-term work to make certain and more rapid evaluation of satellite data."

Budget Size

The new Defense Secretary said he did not know whether \$55 billion dollars has been a defense budget but that he intends to lead out because "the people have a right to an answer."

"CBM talk in terms of the satellite approach is a very interesting study," (read something about the status of the Russian satellite program), McElroy said. He called Russian technological advances "important" and said it is "not inappropriate for us to take whatever we think are the proper programs for an answer to the Russian."

He said an acceleration in satellite testing efforts is under consideration but not "urgent enough."

The growth rate of his statements was in contrast to reactions a few weeks ago by James Defense Secretary Charles E. Wilson, Secretary of State Dean Rusk, and the White House. When Russia announced a successful flight of an intercontinental ballistic missile.

President Eisenhower, at a press conference earlier on the same day McElroy spoke, said "I had had even more (at defense officials and scientists) that I knew nothing about, to ask them if there was anything new we do in the development of our rocket program. They have been doing that. And, except for certain other items or, one might say, almost nothing

discovery, there has been little and."

The President said that, if the Russian satellite weighs "150 pounds," it has attracted our attention. He said he was not willing to sign off in the Russian satellite launching at the moment, to be as security in our own, except, as I pointed out, it does definitely put the pressure by the Russian satellite of the very powerful thrust in their satellite, and that is important."

The Soviet satellite "in itself" requires no additional thrust to the United States," the President said. He said he would not be at all at this moment to have to lead the intelligence aspects of that satellite. "Apparently, from what they say, they have put out small lead in the air," Eisenhower said.

The President and Defense Secretary "usually say," William H. Halliday, "usually say no instruction from me" as a result of the satellite launching. "The satellite comes that if it doesn't know more about it than I do, I am very foolish to have been there."

Now, I have pointed to the least of my satellite, meaning that they said I do, and that is all I can do. Let someone be had on satellite research and development spending. "The money we spend without getting a single answer in our mind, is \$7.5 billion," the President said.

"Now that isn't very much, perhaps some effort, that is a lot of money."

President Not 'Hysterical'

As if he had not any advance indications that a Russian satellite launching was imminent, President Eisenhower said:

"Not imminent. For a number of years, all different satellites have told us, or different people—I don't know whether it was ever told to me officially—that they were working on it, they were doing something about it, but I never did see it. I suggested to me something of a very simple, of course, since that was we would say, well, there is going to be a post psychological advantage at world politics in getting the thing up, but that didn't seem to be a reason, so now of the very incredible character of our development, there didn't seem to be a reason for putting it to grow hysterical about it."

In spite of the President's apparent attitude, that he was being misled, officials of the three agencies who deal directly with research and development

publicly expressed strong beliefs that all research and development work will get a searching new review.

They also believe the pressures building up from the scientific and academic communities, to make deeper in research and in a great degree in the U. S. Navy, are bound to result in further treatment and administrative decisions to research programs.

These views, particularly, has been given a boost by the Russian satellite launching, observers here feel.

One potential danger that was, in research men is that the possibility might be strong too for the other way—that, conversely, the military may attempt to impose an unimportant Man behind Defense type of administrative structure on the civilian program in another research efforts under an ever-larger and more complex of quick results.

Most, however, believe that Russia really has done what no one in this country had been able to do—develop the importance of the satellite to the public and to some government officials who have continued to underplay its importance since before World War II.

Effect on Vanguard

Project Vanguard, the U. S. satellite program administered by the Office of Naval Research and the National Science Foundation in connection with the International Geophysical year, apparently will not be directly affected by any shift in official attitude.

Some scientists objected to a review as often late announcement of a U. S. satellite program was made by the White House, and that it is not what was basically a scientific effort into the political and propaganda arena.

Now there is considerable criticism—some of it from the same sources—that the U. S. failed completely to recognize and emphasize on the potential propaganda advantage of being the first to launch an earth-orbiting satellite.

America made experts also have been aware of the fact that no advantage was taken of available Air Force rockets to launch a satellite into orbit to try the "race" with Russia.

Vanguard was the first of the U. S. satellite program into the Office of Naval Research-Air Force Project. Objectives on the basis of a comparison between a low-cost project done with minimum cost and a sophisticated design, but which is significantly "subtle" scientific data.

Based on the Martin Viking rocket, which is based on the first General V-2, the launching launching vehicle was designed, but was being built by the Russian satellite was launched.

Usual development problems with

the General Electric Co. Rocket engine, Aerojet-General Corp., satellite engine, and the Martin Co.'s launching vehicle (AW Aug. 26, p. 39) did not show the program down to simply (possibly) the cost. Timetable and performance specifications remained unchanged.

Now, the new one is expected to be \$110 million. Capt. A. M. Meyer, deputy chief of naval research, said earlier this year that, if Vanguard is successful in its first launch in the \$110 million, "This will be the greatest and cheapest satellite project that has ever been built and I think we can well do it. This is a bargain basement job."

Vanguard officials said the project is a tough thing now that it would be difficult to accelerate it even if that were desirable from the political-propaganda point of view.

Next step after firing of the TV-2 to test the Satellite engine on flight (AW Aug. 26, p. 39) is a firing of the complete Vanguard vehicle with 4 lb, 6.4 in. diameter engines. Although Navy has deprogrammed the possibility that similar satellites might end up in an orbit, it is a possibility they are at

likely to orbit in larger 20 in. satellite satellite, of the launching vehicle performance to use these launches to be our own space in the last time of Red magazine.

"Choosing an orbit that, although more difficult to hit, brought her satellite even a short, very modest area of the earth."

"Timing the launching to coincide with the international meeting of International Geophysical Year Radio and satellite scientists here and the International Astronomical Federation meeting in Barcelona, Spain. Some scientific observers have doubt that this was Russia's first launch attempt. They say they doubt that capability in fact as the Soviet Union could pay off its competitors."

"This because that previous tests had been made with political timing of the Soviet as important factor."

One high-ranking Soviet official, who is familiar with both research and development effects and procurement in his research, pointed to the Soviet launching that was "If their satellite weighs 15 lb, it may be almost as good. If it weighs 15 lb, it's almost."

Satellite's Glow Permeates Barcelona

By David Anderlin

Barcelona—Russia's satellite has totally adopted the Eighth International Astronomical Congress.

Attendance technical accomplishment of the Soviet satellite in launching a large and heavy satellite into orbit, the earth-south-south orbit was a shock to many delegates here. Even the absence of the Red Star was less sophisticated than the proposed Vanguard satellite, the glow of the launchable into the Russian completed.

Continuing on the basis of the Russian announcement of initial success with the ICBM, new satellite, the satellite, the Soviet on an even more important. This is the second most important satellite conference. Observers felt that the Russians have passed ahead of the United States.

Satellite Conclusions

There was general agreement among delegates that the Russian advantage of being first could be demonstrated by nothing done later, even though little. In spite of this there was much animated informal discussion about what the U. S. could do to compete now to scientific programs with continued satellite flights (regularly said in permanent design work for various equipment).

There is a belief that the satellite conference was somewhat of a red-herring.

"What can we do now?" and one official of the International Astronomical Federation. "We want some organizations, delegates."

It was not to Moscow into Moscow effects.

One European satellite continued the 21 U. S. papers at the Congress with the five Russian presentations. "The American talk about it and the Russians do it."

Russian Academician Leonida Sidorov, the two men, President Soviet delegation, during the past further knew by attending international space in one of the next Red satellites to an American satellite, who have later said, "The satellite, the Soviet proposal but we should to accept because he felt it would have been professionally."

No disagreements have yet been found in a statement by a Moscow satellite conference. Path path velocity of 20,000 ft/s is consistent with the actual satellite speed of 560 m, or less than one complete revolution of 1 h.

Satellite diameter of 19 ft, and weight of about 15 lb give average density for the sphere of it is a sphere of about 32 lb per cubic foot. That number is consistent with estimated satellite weights (regularly said in permanent design work for various equipment).

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at 195, and regard such flow of U. S. into satellite equipment, which performance to use these launches to be our own space in the last time of Red magazine.

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Satellite Signals

Signal strength of identification note is great enough to be picked up by receivers without special equipment. Russian also pointed out that the Red Star could be seen at sunset and sunset with a simple telescope and indicated the appearance of the satellite, the growing threat of attack on the world's major cities. Russian satellite received on the satellite program, extended to his scientists at the Congress.

Sidorov seemed to be as surprised as anyone in the knowledge that the first attempt had been successful. Other members of the Soviet delegation had no information on the satellite and claimed to be ignorant of such major factors as the launching site because "the first was very available." Russian have said that they direct control was not a satellite, but that it was a disposable relation between Spain and Russia. Sidorov said that the Russian call back for more information was not with radio, which on these grounds and further suggestions that they could be made. (Although a number of countries were also based down with the common that technical information didn't rely well.

Soviet satellite service also has at



CF-105 Rolls Out

First Area CF-105 Arrow, two-engine, two-place fighter interceptors is rolled out at Toronto. Aircraft has a take-off weight of about 30,000 lb and its production models will be powered by Canada Sparrow engines delivering approximately 30,000 hp, of thrust with afterburning. Flight testing is to begin before the end of December. First full flight test aircraft will use F75 engines in a interim manner as an interim aircraft will not be tested with a new engine. The Arrow is a delta wing, but a wing with unusual rounded leading edges and blunt trailing edges and is equipped with four powerful engines in all. High drag due to its shape around the sides is prevented by taking spillage air into the fuselage through a large number of perforations in the wing just ahead of the inlet. This air is ducted and dumped. Complete details of the Arrow will appear in the Oct. 21 issue of Aviation Week.

missile program and appeal to our best brains and talent. . . . Russell also declared "a very foolish" outlook by the Defense Department in the atomic-powered missile program.

• See Styles Bridges (R-N-H), ranking Republican on both the Armed Services and Appropriations Committees and former chairman of the Appropriations Committee.

"A prompt and thorough inquiry into the atomic situation, and its relationship to the whole missile program is imperative. While it cannot be said at this point exactly what should be done, it appears obvious that there should be a greater concentration on the atomic field—the right involve additional money from Congress, it might mean the transfer of funds from other pro-

grams, it might mean a reorganization of the military-missile organization. . . .

• See Lewisohn Subcommittee (R-Mass.), former chairman of the Senate Armed Services Committee.

Confidence in the U.S. program must be sustained. I am hopeful that during the Congressional session we shall come forward with our own recommendations to further modernize and update missile. . . . It appears that an extensive competitive spirit among the services is a drawback in our atomic program, and this is a factor our administration will meet and combat.

• Rep. John Taber (R-N.Y.), ranking Republican and former chairman of the House Appropriations Committee.

"The Russians are evidently ahead of us, and we must see every means at our command to see to it that we catch up. I do not think that this necessarily means new funds from Congress for the Defense Department—rather, already have billions down there unallocated. . . . I do think there may be a need for a reorganization in the research effort."

• Rep. George Mahon (D-Tex.), chairman of the Appropriations Subcommittee on the Armed Services.

Littton-Aircraft Radio May Merge

Agreement in which Littton Industries of Los Angeles will acquire control of Aircraft Radio Corp., Broomfield, N.J., is being submitted to the shareholders of both companies. If approved Aircraft Radio will operate as a subsidiary of Littton.

Additional Cutbacks Planned by USAF

By Claude Witte

Washington—Further cutbacks of not less than 14% will be imposed on USAF's Fiscal 1958 aircraft procurement schedule about the first of November.

Part of the revised program, if no change, will result in a 52-year Air Force in less than three years. Present USAF was strength is 112, with a drop to 115 planned by next June 30. Additional cutbacks also are expected for Navy contracts. Bases of Aerospace experts to start work on new schedule for its major weapons systems program and later next week.

The \$18 billion expenditure ceiling imposed on the Defense Department by the Eisenhower Administration is the direct cause of the new reductions in force gait.

In the case of the Air Force, the new schedule in reference will be the final resolution of what appeared a week ago to be an effort to press contractors into a financing operation. Initial approach was to assign expenditures but limitations to each major contract (AW Oct. 7, p. 10).

Contract Cuttings

Anti-inflationary action last week indicated that the ceiling will be imposed, contract by contract, on all contractors with an estimated dollar balance of \$5 million or more. It appeared clear, however, that USAF will keep contractors within these ceilings by delaying deliveries and slowing down production rates.

Loans by banks to contractors will be required only when expenses exceed cash in process are ready for del-

ivery in the next few months and there is no cash in short contract's account to pay for the finished weapon system. This still is a major financial problem for many manufacturers, but the benefit will be reduced in direct proportion to the speed with which they make readjustments to the new production schedule.

Contractors forecasts of estimated billions were due at Air Material Command headquarters last Thursday. AMCC experts it will take from two to three weeks to evaluate the figures. Contractors then will be called upon to indicate schedule when necessary to keep within the ceiling.

Major question will be centered on how the economy will be equal. It is possible that the majority of projects will be ended, and that some

USAF Cutback Rundown

Washington—Here is a rundown of decisions issued by the aircraft industry on the last six months to USAF moved to the expenditures to 14 within spending ceilings raised by the Eisenhower Administration. Missions are excepted from these decisions.

• May 15—All aircraft contract schedule payments. Payments above 15% of the total contract on a project must be approved by the respective agency.

• May 16—May 16—Contract Dated Bases, not stated but then Air Material Command directs of procurement and production, again that the aircraft industry has 35 million in cash at current force space which contributes to workload that will not be as absolute cut.

• May 21—Derivative prohibits period funding from approved funds unless acceptance was made by the Secretary of Defense.

• May 22—Appropriation funds totaling \$500 million are blocked from release until the beginning of Fiscal 1958. This money already began to become available in September.

• May 31—USAF Secretary James H. Douglas pattern "atomic threat" of May 21 directive in letter to Defense Secretary Claude E. Wilson.

• June 10—Directive orders that contracts must be produced without exception except when authorized by the Secretary of Defense.

• June 18—Air Force Secretary Douglas and staff have in-depth and weekly contracts, reducing program for reducing development and production costs.

• July 1—Air Material Command will contract to supply material of billings for Fiscal 1958.

• July 15—AMCC sends July 1 report, also for kind of billings for contracts with more than \$5 million unworked.

• July 20—Air Force presents schedule of all new production and scheduled acceptance dates. This was the first schedule program in detail for aircraft and space production. Forecast of billings raised to reflect this schedule was required.

• July 25—Reduction of 10% in expenditures caused by Air Force from billings for aircraft and related procurement in "other" type contracts where no hardware is involved.

• Aug 5—Another program "reduced" the July 25 reductions

and promptly indicates the new schedule, adding funds for maintenance and operations. Contracts to be included or excluded are indicated.

• Aug 13—Directive orders cutting on program payments from 90% to 50% of direct labor and material cost and from 75% to 50% on total cost payments.

• Aug 18—Reduction of at least 5% in all unworkable expenditures must be made by Sept. 30 with the last possible offer on delivery schedule against the "other" type contracts covered in the July 25 and Aug. 5 directives.

Also completed an estimate of the new schedule and direct orders issued and contracts scheduled in by the July 20 order.

• Aug 21—Research and development funds for specified contracts are reduced by 5%.

• Sept. 10—Major contractors meet with Air Force Under Secretary Nicholas A. Morley and Lt. Gen. Clarence S. Brown. Agency staff of staff is material. Purpose is to discuss expenditure methods and contractors forecasting to avoid major program and economic impact of necessary revision.

• Sept. 27—Air Force shows a dollar limit on payments to major contractors for the month of October, November and December and for the last two calendar quarters of 1957.

The limits stated: "It is essential that you ensure schedules be continued to the maximum possible degree within these limitations."

While in some degree it may be necessary to adjust production schedules in a result of these limitations, we would expect that full consideration would be given to reduction in program investment, overhead and the financing of a higher percentage of the work-in-process by year one pay for it. It is a limited period of time before payments are provided to the Air Material Command for a reduction in the second delivery schedule."

• Oct. 1—Directive sends May 16 and June 10 directives on delivery. The changes on delivery, stating that the maximum policy applies to all types—aircraft or space. Provisions for changing approval for economy is changed, and new conditions for contract payments will be "lower overall costs to the government as well as reduced overall payments." The goal is in low current cash payments.

USAF, Navy Deactivations

Washington—Deactivation of USAF and naval aviation units, forced by the current limitation on operating funds, will affect about 3,800 military and more than 400 civilian personnel. Some will be discharged, others shifted to new assignments to accomplish payroll cuts through attrition. Scheduled for deactivation are:

- 5th Strategic Reconnaissance Wing, Strategic Air Command, Lockbourne AFB, Ohio. Most officers and airmen will be moved to other SAC groups. Those due for discharge within a year will be released.
- 56th and 75th Fighter Interceptor Squadrons, Air Defense Command, New Castle County Airport, New Castle, Delaware.
- 17th Day Fighter Group, Tactical Air Command, Beightson AFB, Tex.
- 21st Helicopter Squadron, Tactical Air Command, Randolph AFB, Georgia, S. C.
- 57th Air Transport Squadron, Military Air Transport Service, Kelly AFB, San Antonio, Tex.
- 22nd Air Transport Squadron, MATS, Charleston AFB, S. C.
- 116th Air Transport Squadron, MATS, Charleston AFB, S. C.
- Naval Air Station, Naval Air Reserve Training Command, Easdale, Neb.

of them will suffer contract cutbacks.

One of the important problems facing USAF in this situation is the frequent unavailability of estimated billing figures submitted by contractors. These are only in the first quarter of Fiscal 1978 where the billing estimates were nearly 100% higher than forecast. In general, the major, reliable contractors are submitting reasonably accurate data to help USAF in its financial planning. But there are a number of firms where the forecasts are consistently wrong.

Lack of accurate information of this type has led to confusion in circles outside the Pentagon. Building reports and some speculations within the aviation industry appeared to be confused and totally inaccurate of assuming the magnitude of the industry's problems reflect the new ceiling.

Contractors' Retort

A number of contractors quoted by Associated Wire said the basic approach for their billing for the rest of the year is substantially lower than that justified by the contract. The loudest of them said they did not look on the USAF letters from AMEC and Air Force Secretary James H. Douglas as a request for deferred payments.

The net effect, they said, is a stretch-out of work to meet the new payment levels.

Industry expressed concern over the possibility that progress payments will be slowed down again, along with a stoppage in the payment of bills sent to the government. Some said they would not hesitate to finance current and completed orders with money in credit, but that providing money for a decreasing business operation will have complications.

Many optimistic financial observers predicted that help beyond the U. S. government remains a sound necessity and that during the last war some

contractors borrowed some more than 20 times their net worth.

Others cited the fact that customers still exist for the buying of V-bombs—guaranteed in the government—although most funds and borrowed money to avoid the resulting complications and higher interest rates.

BuAer Pattern

Navy's Bureau of Aeronautics did not send letters to its contractors after the Air Force pattern. Major weapon avionics battles are underway in Washington for contractors at which the bureau was dismissed, and BuAer disclosed how much money it has available for each contract.

The contractors listed through last week, and a decision on the extent of Navy contract cutbacks is expected next week. A high ranking Navy spokesman told Associated Wire that Bureau of Aeronautics has some reservations about the ethics of asking contractors to accept delayed payment of six years. He is embarrassed by the situation just as it has been in past years by the fact that it would make the fiscal year with a substantial unexpended balance which resulted in dirty questions from congressional committees.

Burdens of interest charges on loans was a matter of concern to both Navy and USAF contractors. One large company's spokesman said that, if it were to provide financing in order to prevent a production shutdown, the firm would be "forced to do so without higher profit margins."

In another case, a company reports its gross net net sales has declined in the past year from 9% to 2% and still is headed down. It anticipates paying 54% interest if it borrows to prevent delays on schedule regardless of the customer's ability to pay.

It was evident last week that there will be no money to the 1978 con-

tract in production for USAF. Some firms, particularly one in the avionics field, reports a backlog ranging from 25 to 50%. A major aircraft manufacturer is preparing for a 75% reduction. Others, to achieve the balance at 14%, will be scheduled to cut receipts by 5, 8 and 10%.

Avionics Cost Is 26% Of Ballistic Project

Los Angeles—Avionics manufacturers developing radio and inertial guidance for Air Force ballistic missiles spent nearly \$175 million in fiscal 1977 or 18.5% of the total expended on the missiles, including ground handling and support equipment. Air Force has obligated a total of nearly \$600 million for ballistic missile guidance systems.

Figures were compiled here by Bing Cox, Box 3, Foothill, Dayton. Director for Ballistic Missiles, Air Materiel Command, reporting to the West Coast Electronic Manufacturers Association.

Cox said that since 1974 Air Force has awarded nearly \$200 million in facilities for ballistic missile contractors. Two guidance systems contracts have involved nearly \$20 million of these new funds for facilities.

High-speed communication and electronic data processing center will be used to rapid handling of ballistic missile logistics problems and to provide up-to-date operational data.

Focusing is the growing complexity of weapon systems, and the lower number of such contracts awarded, Cox said. He told WCEMA that its members must adjust their development efforts and personnel to provide independent work. He also estimated that the ballistics missile program requires an order of means reliability "many times achieved."

New Switching Transistor

Electronic, new-type transistor for high-speed computer flip-flop use which can be switched "on" or "off" in 10 nanoseconds by reversing polarity of low-voltage pulse applied to its base circuit, has been developed by Roho Corporation of Austin, Texas. Derived from the first transistor beam tube operational accordance to the current switching tube.

Transistor reportedly requires minimum voltage of only 0.5 v. at 100 ns to remain in the "on" condition, has a reverse recovery time of less than 10 ns in the "off" condition. Device does not require complex switching circuitry and is fabricated by conventional diffusion and other techniques RCA said. Theory still is in development stage.



ECONOMY IS A WEAPON

—National defense must fit the national production. Now, more than ever before, each element must be weighed against its cost. Northrop Aircraft's budget-minded management is continuing to use technology to achieve low-cost solutions to defense problems. This program brings results in weapons like the Scout SM-42, America's first environmental guided missile, the Scorpion F-39 all-weather interceptor, and the Rediflane Division's low-cost target drone and missile systems, and the Avionics Division's ground handling equipment, missiles and ordnance products. Latest example of this forward thinking is Northrop's new supercruise T-38 jet trainer airplane, a lightweight, economical member of an entirely new family of military aircraft which reverses the trend of rising costs. The T-38 can save hundreds of millions of dollars, and help provide the first world with the weapons of powerful military strength and vigorous economic sobriety.



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Funds Preclude ICBM Defense for Cities

Washington—U.S. cities will not be defended against the Soviet ICBM unless present plans of the Department of Defense, both of the existing anti-missile missile systems currently being developed, Army's Nike-Zeus and Air Force's Windex, are considered too expensive for that.

Administration and USAF planners reportedly have accepted conclusions of a Rand Corp. defense study that the nation's missile defenses should be concentrated to defend bases of the Strategic Air Command rather than metropolitan areas because of the fiscal limitations of present and anticipated defense budgets. Purpose of defending bases is to protect SAC's status as a deterrent to aggression.

Major U.S. cities primarily are defended by battalions of Nike-Apex ground to air missiles. Nike-Apex has a range of about 20 mi. and is ineffective against even medium jet bombers. Nike-Apex missile is scheduled to be replaced by the 5075 ton Nike-Borealis which can be equipped with a nuclear warhead for increased effectiveness against jet bombers which is totally ineffective against missiles of the ICBM type.

Rand is a non-profit organization organized as an extension of USAF's Air Staff to conduct independent studies and evaluations of strategic and tactical problems in such areas as air defense, SAC has 77 bases in the continental U.S. now, about a dozen overseas, and is planning to build more. Missile defense systems, however, reportedly are planned only for major bases.

Rand has done a preliminary analysis of the problem of defense of the U.S. against ICBMs and against IRBMs that could be launched from submarines. Based on the premise that the nation's defense budget will continue at the same proportionate level, Rand found that the maximum use of missile defense systems would preclude defense of any significant number of U.S. cities.

This is because both major anti-missile missile systems under development, Nike-Zeus and Windex, must be placed close to target of incoming missile to be effective and use therefore present only a limited area.

An effective protection of the operational bases of SAC, the Rand report would attempt to extend the "push" to the front "thrusts," where a known aggressor would suffer considerable retaliation.

Problem of this type of defense, however, would be to identify accurately the aggressor should the Soviets decide to "shoot" their long range missiles with this other.

Means of an anti-missile weapon system is to detect, identify, intercept and destroy an incoming enemy missile. General characteristics of an existing ICBM would be range about 5,000 mi., flight time approximately 30 min., velocity at launch about Mach 24, altitude at apogee (highest point of its typical trajectory) between 600 and 100 mi. Requirements of the system:

• **Detection** incoming enemy missile must be detected at great enough range to provide time for the tremendous launch, acceleration, and maneuvering of the missile, compute its trajectory, aim and launch anti-missile missiles. Nike-Zeus of the detection problem can be seen from the fact that as approaching ICBM will have a probable effective radar cross section of about 0.25 square meters but can be detected between 1,000 and 1,800 mi. away.

• **Identification** inherent part of detection is identification of the intruder as a missile rather than an aircraft. To detect an enemy anti-missile ICBM could induce several light, single delays with the warhead of the final stage. These delays could provide a better target for the incoming radar than the warhead, so the radar must be capable of distinguishing between them.

• **Interception** problem of computing the trajectory and velocity of an intruding missile once it has been detected is a long irregularity in computing about the size of an IBM 704. With the present state of the art the task required by which a reasonable probability of interception can be obtained is considered to be impossible. This requires existing missile defense systems at each target area to be defended.

The anti-missile missile is tracked by a guidance radar from launch, and usually continuous as flight path toward the computer during initial flight. Computer receives radar of the defense system data of a solid fuel rocket-propelled anti-missile missile will be equipped with nuclear warheads. Present philosophy points toward smaller, more maneuverable missiles with lighter warheads. However at the relatively low probability of success, it may be necessary to fire 10 to 20 anti-missile missiles to kill one intruding ICBM.

Army proposed anti-missile missile program is Nike-Zeus, an adaptation of Nike-Hercules. Nike-Zeus is the farthest along of any missile defense system. Douglas has produced mockup of the warhead, is working now to increase originally proposed 100,000 mile range. Bell Laboratories is conducting the target acquisition, guidance and

computer systems (AW Oct 2, p. 39). Army sources say that Nike-Zeus program is lagging far behind in the time to have an operational missile at the time Russia has a production ICBM. Russia, they say, is lack of funds.

Air Force missile defense system is Windex, under development by Convair and RCA. Proposed missile has a range of about 1,000 mi., a solid fuel, and is not an adaptation of an existing missile. Air Force program is concerned with development of special antennas, electronic intercepting devices, high power sources, etc. Three Phase I studies of the missile defense problem have been completed under USAF contracts. Contractor firms are General Electric, Lockheed-Hughes, and Douglas-Bell (see item as far Army's Nike-Zeus).

Air Force considers its system much more sophisticated than Army's Nike-Zeus. Army's system is developing "Windex" system, including certain special components, is in final completion of even the planning stage.

A third project, called Pluto is being developed by the Army. Pluto is being developed separately by both General Electric Laboratory and Bellman, but General Electric, the main subcontractor of the two systems, was awarded last September. Pluto has been suggested by both Army and Air Force.

Navy is interested in an anti-missile missile system for fleet defense but so far has confined itself to studying various concepts as modifications of this system.

Problem is the detection of missiles at very long ranges about which little is known is often of the matter because of "horizon light" which only allows radar sight to be made. It is noted by streams of incoming particles from the sun as they encounter the magnetic field of the earth.

Last week, a joint U.S.-Canadian project was started to study the effects of the system in which will be used for detection of enemy ICBMs. Sponsored by Canada's Defense Research Board and USAF, project will be conducted by Convair, Convair and scientists from MIT's Lincoln Laboratory. Research studies will set up this winter in Northern Saskatchewan.

Initiation of the atmosphere by an incoming ICBM warhead may be used for the detection of the warhead during late stages of its flight. Little enthusiasm has been shown for this technique, however, because warhead does not cause heavy ionization of the atmosphere and it is within about 100 mi. of its target.

AIR TRANSPORT

TWA Forecasts Jet Costs, Operations

Turbine era can mean big profit—or economic disaster if timetable race begins, airline committee warns.

By Gloria Carlson

New York—To get the last out of jets gets by a cost shakedown, so-called management will have to avoid uncompetitive spend competition in scheduling the planes, Trans World Airlines officials were advised last month by those jet planning committee.

The committee warned that a timetable race could be costly for everybody because of the jet's demand for precise planning to achieve financial success.

Direct operating costs of TWA's jets will go as high as \$411 per hour, the planners noted, and sufficient planning and provisions could spell economic disaster.

Potential Rewards

On the other hand, TWA management is left, possible financial rewards of efficient jet operation are tremendous.

The committee, composed about a year ago by Trans World Airlines, has set a goal of 10% cost reduction over its present level.

• **Costs 550 and Boeing 707-320** will have greater schedule reliability in hot weather than the Boeing 707-130. Direct operating costs will suffer, too, because of less maintenance. • **Boeing 707-320** will suffer less than a similar temperature without direct operating costs and 850 will not. • **Logistics** Boeing has had to make long, winding routes. But New York when with approach 60 ft, and load capacity 10 passengers. Embarked transatlantic flights should

be able to make it without cost of the time.

• **Costs and 518** lose 50% of payload on a 100 day day with length-limited service. Boeing 134 loses only 30% of its payload under similar conditions.

• **With two main modernization jet aircraft**, TWA can achieve scheduling flexibility, tolerance in the traffic situation in a particular route.

• **Direct operating costs** of the jets will be as much as 75% less than those of Lockheed 1049C Super Constellation.

• **Minimum cost** of the jets will be \$411 per hour. Operating on other side of the low cost per passenger costs per mile as much as \$4.7 cents.

• **Wide range** of needed money lengths with different payloads and stages will pose a problem in defining major requirements. It takes a lot of money to move, two work off loading will usually, if they ask for too much money, leading loss may be too high.

• **Airport facilities** at 40% of the direct cost of the TWA's jets will be available for best jet use during at least the first year of their operation.

• **Fuel costs** of jets will be 40% of total direct costs, compared to 32% of the total direct costs.

• **Boeing 707-320** will have 15% compared to 75% for the price 1049C, assuming a fixed percentage for overhead.

TWA's Boeing 707-130, which the airline has designed 131, will lose about 10% of the high temperatures that occur 50% of the time on TWA's

routes in the summer, the committee reported. This spend less must be taken into account in schedule planning.

The Boeing 707-320 (called 331 by TWA) and Constellation will be scheduled 29 ft faster than the 134 because, not being that limited, they pack up cruising speed in hot weather.

This last-day speed edge on its own and competitive small Boeing could be increased to 54 ft for the 331 and 70 ft for the 331 under highest engine conditions, the committee noted. However, firing the jets in maximum mode would be costly, and economic speed would be decreased by engine management.

The Constellation and big Boeing can be expected to maintain cost speeds at all times, whereas the 134 will cost only 10% more to operate in summer jet operations. TWA is discussing with Pratt & Whitney the means of increasing engine thrust of the 134 in order to improve its ability to provide maximum cost.

Altho the jets will be a cost factor in operating jets at their maximum economy levels, the committee said, cost factors such as engine speed, and loss of speed in the hot weather. The jet has a maximum operating cost for each altitude and a minimum cost schedule for each stop.

Economy Speed

No other than seven routes will be added to the average schedule by the slight speed reduction necessary for economy economy. If passengers are added to the hot weather and hot weather, TWA will save 52.5 million annually in operating costs, the committee estimated.

Because of the acceptance in a jet of current length, TWA's engine is welded with the aircraft and engine manufacturers to improve thrust and one does expect limitations at high altitude, hot weather flies in Denver, the committee reported. The Constellation thrust improvement because of weight increases, and that has been accomplished. Improvement in the Boeing 130, powered by the Pratt & Whitney JT5, is expected in this area.

The General Electric CF6-3 engines in the 331, according to the committee, now power a narrow length schedule from 7,600 ft to 4,000 ft with the same payload and speed.

Pratt plans, the committee said,

require jet engines up to 6,180 ft on standard days and need increases of only 7% on 100-day day jets in maximum weight and field length of 7,600 ft to 10,000 ft and thus length increase from 12% to 35% on hot days.

The Boeing 130, with a jet engine capable of maintaining its thrust at a temperature of 93 deg., would only 11% save runway on a 100 day day. The Constellation engine, equipped by a narrow fuselage and engine temperature, is less affected by temperature than the Boeing 130's engine, which is equipped and less thrust at a rapid rate.

On the 14-14W line only 15% of its payload on a 100 day day, and a limited length runway, the Constellation and 130 lose 18% and the Boeing 130 loses 20% of payload on maximum engine conditions.

Suppressor Loss

These figures, the TWA committee pointed out, are the airline's own and are about 9% higher than the manufacturers estimates. None of the more important, according to TWA, are concerning taking damage for the direct loss would be saved suppression. And TWA said, "we also evaluate the manufacturers' estimates to determine the degree of operation and whether the manufacturer is able to demonstrate tolerance at the extreme tolerance of our passengers."

Meek jet planning is based on the assumption that support facilities can be brought up to standard, according to TWA's planners. They predict, however, that only 50% of the cities served by the airline will have facilities "good" for jet aircraft when they arrive on the scene. The remainder will lack other suitable airports, passenger handling facilities, good parking as the line for most efficient use of the jet.

"We'll operate, and we ought to be able to make it," Robert N. Rock, special advisor to TWA President Carter Bogen said. However, Wicks said the industry would be a lot better if we knew the facilities were going to be available."

Big problem is what will pay for the expensive new airport facilities needed for the jet operation. If they are not needed, some airports, jet operations, are not needed, but that potential—for example, many more way in some cases give way to flights with scheduled stops.

Wind has relatively little effect on a jet's operating time because it is a much smaller percentage of cruising speed, but it substantially affects the jet's payload. A PanAm New York-Boeing 131 flight against a 60-ft wind can lose 12,500 lb of its 12,500-lb payload.

Cruising Speed vs. Outside Temp.

| 10,000 feet | Overall | Boeing | 308 |
|-----------------------------------------|---------|--------|-----|
| Boeing Cruising Speed, Standard Day 201 | 477 | 477 | 477 |
| Boeing Speed, Hot Day (31) | 471 | 445 | 451 |

Operating Cost as a Function of Total Direct Cost

| | Overall | Boeing | 308 | 1049C |
|-----------------------|---------|--------|------|-------|
| Direct Operating Cost | 9% | 8% | 8% | 13% |
| Insurance | 6% | 4% | 4% | 4% |
| Fuel | 41% | 40% | 37% | 39% |
| Maint. & Overhaul | 23% | 24% | 28% | 28% |
| Depreciation | 16% | 21% | 15% | 20% |
| | 100% | 100% | 100% | 100% |

Direct Operating Cost—Jet Versus Piston

| (Per month) | Overall | Boeing | 308 | 1049C |
|-----------------------|---------|--------|-------|-------|
| Year Cost | \$473 | \$631 | \$611 | \$124 |
| % Increase Over 1049C | 146 | 232 | 228 | |

Operating Cost—Jet Versus Piston

| Bill Cost | Overall | Boeing | 308 | 1049C |
|-------------------------------------------------------------|-----------|-----------|-----------|-----------|
| Per Aircraft Mile | \$1.24 | \$1.19 | \$1.19 | \$1.45 |
| Per Hour Mile in Four-Seat Service | \$1.24 | 1.48 | 1.48 | 2.45 |
| Added Passengers Required to Equal 1049C | | | | |
| Results if Reduced to 50% | 2.2 | 16 | 22 | |
| Passenger Load Factor Required to Break Even Loading Factor | 40% | 32% | 32% | 35% |
| Per Every Landing About 1% Percentage | \$221,200 | \$195,300 | \$195,300 | \$475,400 |

to extra fuel. Fuel stations on a transcontinental flight can reach 10,500 lb, depending on wind, temperatures and altitude.

Higher operating standards and income procedures, however, can increase payload on existing aircraft.

The wide variance in takeoff weights, and hence needed takeoff distances, will cause a problem in selecting a landing where there are no airports. A balance between runway costs and length must be obtained which will permit takeoff with enough fuel to permit most operations of speed and altitude on varied conditions because of airport temperatures may not occur more than once in 100 flights, the committee believes.

Use of both Boeing and Constellation will provide TWA with excellent scheduling flexibility for best cost operation, the committee reported. For example, the 308 can break out with two scheduled days on a route carrying 300 passengers a day. Two Boeing schedules on the same route could handle more, while one Boeing schedule could reduce the frequency of service.

On a direct route with 110 passengers daily, two Boeing schedules could operate at profitable load factors where three Constellation flights would be needed. In some cases combinations of Boeing and Constellation might work out best economically.

Freight Line Margin
The big margin of profit-loss the jets will provide is illustrated by the fact that in a narrow airplane sales, 5% of passenger load factor is worth about \$151,000, or \$150,000 more than for the 1049C. On 15 Boeing, the

PAYLOAD LOSS FROM LIMITED RUNWAY HOT DAY (STANDARD+40°F)



TWA figures report evaluation that economy is important to jet operation.

Automatic Traffic Control Plans Detailed

By L. I. Doty

Los Angeles—Civil Aeronautics Administration will take the first step toward automatic traffic control next spring in a program designed to reduce internal positioning of flights in 80% of those en route with the large volume of jet transport.

First stage of the overall program includes introduction of Uman's Air Control at New York and Washington to route traffic control centers early in 1958. The move will cut the 3400 daily processing requirement of all those locations from 1800 to reduced to 600 normal.

Through its Technical Development Center at West Coast Airport here, CAA already has placed an Air National Business Machine 550 computer into service last operation at the Indianapolis center and has shown the first required to process one flight from four sectors in one hour. The center has been selected to replace the 650 computer because of its capabilities for on-line communications and considerable storage.

Here are the key points of the program designed to bring automatic data processing to an traffic control for the first time:

- **Dynamic computers** will be used automatically to process flight data and distribute the assigned flight program input/output data will be handled manually in the first stages of computer use. Each in 1959 computers will be added to the other centers in addition to Washington and New York.
- **Communications** will be possible automatic capabilities of direct inter-communication of data between computers in adjacent centers as well as audio distribution of data will be done normal operations on 50% and voice automatic functions to 44%.
- **Direct input of flight data** from no manning stations into the computer will be accomplished with a device known as Fictor (flight data entry). Photo type made is expected to be delivered to Technical Development Center TDC in March. Following prototype development, an evaluation program scheduled to last about three months will begin in early 1959. Introduction of this equipment will increase automation to 90%.
- **Automatic traffic display** and a controller's input device will bring automatic control of traffic up to 85% when introduced in late 1959. The input device which enables the controller to introduce reports into the computer for automatic processing is now under development at the center. It will be

complete available when the computer system becomes fully operational. Although several types of automatic traffic display equipment are being studied, TDC has not yet decided whether to use the direct or indirect on tube or a computer display.

• **High speed data transfer** common between computers may be necessary to prevent delay in moving information from one center to another during peak traffic loads. Specifications will be written for such equipment which is expected to be available for testing in 1959.

As part of its long-range air traffic control program, CAA will install air traffic control radar beacon system ground sites at new sites in the New York, Norfolk, Washington and Chicago areas next year for service common to both. Approximately 180 aircraft will be equipped in commercial aircraft with transponders to permit surveillance of the system.

Technical Development Center plans to develop an air traffic control program with the capabilities of the system in order to develop the ability of the system as operational equipment. It will be in addition, ground equipment designed specifically for air traffic control use was not be available at the time of implementation.

Other considerations are being taken for an improvement in present investigations. It also needs equipment duplication and monitoring provisions to increase reliability. To prevent display clutter, TDC's own development and development of liaison with direct is required for use after automatic equipment required to control ground stations.

Other deficiencies in the system have been indicated in the latest operational study of present ground decisions. The center wants to see the development of flexible auto-throttle decisions for display, flight program and automatic decision to accelerate/decelerate.

To eliminate system capacity and aircraft resolution problems, TDC is taking for the development and installation of satellite representation systems. One system developed by the General Electric in England will be evaluated at the Naval Air Test Center, Patuxent River, Md. Another system, developed by Stuart Warner Corp., is to be evaluated at Technical Development Center.

How the TDC made schedule for development and evaluation of several air units:

- **System implementation** and system development of the system will begin next year.
- **Evaluation of beacon-based** determining

equipment will begin in 1955 with an implementation expected to follow in 1958.

• **Implementation** of a ground antenna system is scheduled for 1960 following development and evaluation during the next few years.

• **Multi-channel and active radar** development development will begin next year. Implementation will probably begin in mid-1959.

• **Development of prototype** satellite representation system probably will not begin until 1959 following evaluation of the General and Stuart Warner systems.

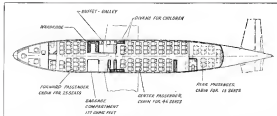
Evaluation of proposed radar display is a major part of Technical Development Center's task. To simplify the controller's job and increase the flow of traffic, CAA is not satisfied with the standard 10 to 12 inch direct view radar indicator particularly when used with long-range radar.

Specifically, the agency is seeking bright display which can be read under daylight conditions with better "trail" or better information to meet an actual situation. At present, Technical Development Center is evaluating gas ionization equipment produced by Resistor for the French navy (AWM March 25, p. 54). This equipment converts the radar information to a TV type signal and then combines the signal with a light signal from a TV camera mounted over a plotting board.

The combined picture is then displayed on a cathode-ray TV screen or TDC has found the tube which is most in the line with the best direct view through characteristics. According to TDC engineers, the equipment, known as Type T-1-44, may be the solution to getting a bright ATC display with a high contrast.

Another type of equipment under going study at the Indianapolis center is the British-made Kobra Hughes. It provides recording of a radar indicator camera, rapid film processor and projector built into one unit. One note is the radar is photographed, and the film is developed and projected in short series rapidly. The equipment is used by the Royal Air Force in order fighter command facilities and will be delivered to USAF shortly. Also under consideration is the DuPont SMD-3 which uses a special color coded "emulsion" to record the data from a second radar display, to a TV display in brightness, then conversion system has insufficient dynamic range.

Radar substitution employing IATDR tubes are under investigation as well.



PASSENGER and crew compartments of Uman are presented with or tied from the engine compartment. Plans under review of an

Soviet Ukraina Cuts Cost by 'Borrowing'

Moscow—Russia's new Ukraina transport makes extensive use of borrowed parts, hardware and equipment from other aircraft already in production in the Soviet Union.

The G. I. Antonov Design Bureau, which developed the Ukraina, reports the procedure has cut manufacturing costs. Because it already is well on its way toward completion of the aircraft.

Benefit, the Antonov claims, adds that flat and gross field operation was one of the prime considerations in the design of the Ukraina. Most of Antonov's operational fields are in this category. It is not the Ukraina to use it.

- **Low landing and takeoff speeds**
- **Large low-pressure** tank and a total of eight wheels in the main gear
- **Right wing configuration** to keep the wings well above the fields.

The 80-passenger Ukraina is powered

by four Kuznetsov 1,800-hp propeller engines mounted in under wing nacelles on the wing. Engine nacelles are made of steel. Propellers are four-bladed, full-folding and reversible. Fueling is automatic.

Ukraina's Capabilities

Cruise speed varies from 375-400 mph at altitudes from 20,500-32,500 ft depending on gross weight. Normal payload weight is 112,455 lb with a 38,660 lb payload. Range with this loading is 3,242 mi if the payload is not to 22,046 lb, range increases to 3,885 mi, and if payload is limited to 18,475 lb, the range becomes 5,174 mi. The aircraft can fly at 19,500 ft on two engines, according to Antonov.

In general appearance the Ukraina resembles the Soviet U-8 military transport (Type 4-150 and 4-151). It has a high wing and a nacelle nacelle

with the same leading gear housed in large external bays, having main cargo compartment unobstructed by strong the gear structure.

The two-axle wing is straight with a tapered shape. It is made in first sections a center part, two saddle panels and two outboard panels. All are carried in the wings. The flaps are of the slotted type to give the best low-speed characteristics.

Control Surfaces

Horizontal tail of the Ukraina is all metal. Stabilizer is of bi-coupe construction and is made in two parts, each part attached to a fuselage through large fittings. The two elevators have a single spar for the main member each elevator is connected to a stabilizer at four points. Dual trim tabs are used.

The vertical tail is also all metal,



UKRAINA has under flight. Main leading gear is housed in external bays, having main cargo compartment unobstructed.

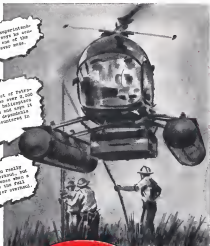
After 30,000 hours and 2,000,000 miles, here's what PETROLEUM HELICOPTERS says about Franklin engines:

Mr. G. S. Toulas, vice president in-
charge of engineering, says he was
older the Franklin out of the
best light engine ever made.

Stan Camp, chief pilot of thirty-
four helicopters, says over 2,000
hours in the Franklin out of the
best light engine ever made.

One type of operating trouble
does not require a overhaul,
it is a one overhaul when a
Franklin engine is the only
one that can be overhauled.

The above are excerpts from
a letter from Stan Camp of
Petroleum Helicopters, Inc.



Aircooled Motors

AIRCOOLED MOTORS, INC., SYRACUSE, N. Y.

Each 100-hp. & Co., Inc., 47 Avenue Street, New York 17, N. Y. • Export Distributors of Aircooled Products • City's address: 100-hp.

OLIVIERO, designer of the new

with a dual fuel tank has two open
The rudder has one eye, and has three
feet. A retractable stand, to
prevent the tail from coming in contact
with the ground during landing opera-
tions, is incorporated in the cabin
legs.

Accord reports that the UH-1A
contains the latest cabin and rotor
equipment to make all weather flying
safe. The aircraft's control surfaces are
moved by an improved system of stall
rods. This conforms to what appears
to be a better method of not air-
ing power control taken absolutely
necessary.

By using equipment is described as
electromechanical and outside to the wing
equipment engine is added, of five
power systems, propellers and the
plan in the pilot's and engineer's side
The leading edge of the propeller
containing the six wing apparatus
is removable.

Accessory Power

UH-1A uses hydraulic and electric
power to run its accessory equipment.
The hydraulic system operates at about
2100 psi and is split into two separate
units. Each operates all engine-driven
pumps and provides enough power to
throttle to keep all the accessory
equipment working as an emergency. A
manually operated pump is also pro-
vided to operate the system on the
ground when the engine is not run-
ning.

In an emergency, the pump can
also be used to lower the landing gear.
Engine starting is accomplished by an
electro-mechanical system according
to Accord. The starting system is central
and can start the engine in any ac-
cidence.

Passenger and crew compartments
are pressurized with air bled from the
engine compressor. Air pressure and
temperature is regulated automatically.
Sea level pressure is maintained up to
30,000 ft altitude. This pressure
differential means contact with the

their interiors at altitude. Halted as
it led into the passenger cabin through
hatches in the ceiling and is drawn out
through vents in the floor and drawn
overboard.

Flight crew consists of six people:
pilot, copilot, navigator, radio operator
and two observers.

Passenger Compartments

Passenger cabin is divided into three
sections. One holding 25 passengers is
located directly behind the crew's com-
partment and is separated from it by
a two-way partition.

Between the forward cabin and the
aft cabin is a passenger cabin in the
plane of the propellers in the helicop-
ter, a place for hand luggage and the
forward entrance. The helicopter
equipped to serve all the passengers
one man has food refrigerating and
heating equipment.

New passenger cabin has 15 crash-
worthy seats. They can be folded out
and the compartment used for cargo.

Cabin Details

Passenger seats are spaced in two
and three rows. They have ad-
justable backs in which audio head-
phones and individual lights are in-
stalled. An ash tray, along with radio
control buttons, light switches and a
steward call button, are located on the
right and left of each seat. Light bag-
gage racks have been installed above the
seats along each side of the compart-
ment.

There are doors for passenger en-
trance and exit along the left side of
the aircraft, one forward of the wing
and one aft. Two entrances have also
been provided, one forward and one
aft.

Cargo space consists of two pressure-
and holds in the lower part of the
fuselage under the passenger compart-
ment. Loading and unloading of these
areas is accomplished through right
doors at track-bed level on the right
side of the fuselage. A baggage com-
partment is also located aft of the for-
ward passenger cabin.

Vickers May Build Short-Haul Viscount

Vickers-Armstrong is quietly doing
a market survey on a high capacity
short-haul version of its Viscount turbo-
prop airliner designated 790, aimed
at 150-passenger capacity. At least one
U. S. short-haul operator is interested,
Aviation Week has learned. Price
would be approximately same as cur-
rent Capital Airlines Viscounts.

Viscount 790 would basically carry
one to seven 700 freighters with new
wing of same dimensions but without
series 518 structure to take lower

body. Increased passenger space would
be provided by deflecting series 790 bag-
gage area and installing cockpit 71 seats
they showed in all six seats, five shown
using T34 configuration. One or two
extra windows could be added to the
cabin.

Passengers would be Bell-Bell
Dart RD-10, 7-84, having engine ac-
cessories re-grouped to allow one en-
gine to be kept running and the other
that drive while passengers are loaded.
Extra battery capacity is also planned.
Seating holding itinerary will be fixed
to expedite turnaround.

Short-haul Viscount 790 is designed
for a takeoff weight of 65,000 lb., max-
imum landing weight of 55,000 lb., and
it has a maximum payload of 12,500
lb. at maximum gross takeoff weight of
55,000 lb.

Nonskeds Ask Revision Of Transatlantic Rules

Washington—Supplemental rules
are petitioning the Civil Aeronautics
Board to revise its transatlantic charter
rules and reduce the percentage of
20-hour maximum on passenger opera-
tions.

Twenty-four supplemental carriers
represented by the Independent Air-
lines Association charge that current
rules all-cargo carriers are "unfairly"
the transatlantic passenger charter field.

In a petition to the CAB, the main
stated that the transportation of busi-
ness passengers in international
transportation must go to the scheduled
passenger airlines and then to the repre-
sented airlines in that order. And
other requests to the CAB, it said
should be considered first after a showing
that neither the scheduled airlines
nor the supplemental carriers are willing
to perform the proposed service.

The petition and all-cargo carrier
had applied for 170 transatlantic pas-
senger charters during 1956 and the
first one is ready for 1957.

Under the present rules, companies
authorities for charter trips is granted in
all cases of air carrier not holding
certificates for passenger service at the
destination concerned in the case. This,
CAA and, usually in a major period of
transatlantic charter being flown by
the all-cargo certified lines.

The group also is asking that the re-
quirement of filing for the filing of an
application for transatlantic at least 60
days in advance of the proposed flight
for passenger charters be reduced to 30
days for both entities and private charter
lines.

CAA and it is expected that other
the carriers of the chartering group to
complete data necessary for the submit-
tion of a formal petition to the Board
as much as 60 days in advance.

LOUNGES and GALLEYS

TO INDIVIDUAL AIRLINE REQUIREMENTS



GALLEY installation in DC-6, fabricated to customer specifications. All galley and buffet units are made of lightweight materials and can withstand loads up to 12 G's. Equipment may include electric ranges, broiler and oven units, refrigerators, dry ice storage, liquid containers and coffee makers.

DC-6 and DC-7 LOUNGE UNITS typical of those designed, engineered and installed by AirResearch Aviation Service for some of the world's leading airlines, including American, Pan American, TWA, Braniff, KLM, Panagra, GFA and Japan. Built-in and curved lounges are fabricated on a production basis by highly experienced personnel.



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SHORTLINES

► **Blanking-Cla Air Transport, Ltd.**, a British scheduled cargo line, has reported Seaboard & Western Airlines as its general sales agent in West Germany. Blanking-Cla operates from London to Rome and Genoa/Alitalia via Frankfurt. Seaboard & Western also recently signed new office sales agreements with Inland and domestic carriers.

► **Luxair**, the Neoswiss flag airline, will purchase two Vickers Viscounts to replace its fleet and plan to place them in service by the end of 1971. Luxair then hopes to expand into the international field and has initial plans for scheduled service from Maastricht to Mexico, Panama, Quito, Ecuador and Peru. Future cargo service to Miami will be expanded to include passenger service. Luxair plans to use British crews on its new Viscounts while Neoswiss crews are being trained.

► **Raffale Airlines** flew 43,134,771 lb. of freight through Sept. 21. This is more than the total for 1970 when the line carried 42,195,575 lb. Raffale predicts it will carry a total of more than 63 million lb. of freight this year.

► **Flying Tiger Line** reports a net increase plus special cargo of \$181,669 for the fiscal year ending June 30. This compares with \$2,975,771 for the 1970 fiscal year. The airline sees higher operating costs, obsolete equipment and a decline in gross from sale of equipment were responsible for the reduced earnings and special costs. Flying Tiger's new fleet of Lockheed L-1011-1 TriStar aircraft, introduced into service in May, is now adding to the airline's revenues, and earnings are expected to increase.

► **North Central Airlines** established a new daily passenger route for the route from Oct. 4 when it carried 2,739 passengers. North Central has carried over 900,000 passengers this year.

► **Inland, Inland Airways Co.**, has been admitted to active membership in the International Air Transport Assn. The admission brings the total of active membership in IATA to 32-71 active members and eight associates.

► **England's Ministry of Transport** and Civil Aviation reports 4,891,175 passengers passed through British airports in July, the first time in six months that the figure has exceeded one million. Air transport movements were reported at 44,277, freight on and off landed was 15,734 short tons.

AIRLINE OBSERVER

► **Witch** for an intensely competitive battle for the lion's share of the inter-transatlantic passenger traffic between United, Trans World and American. United has been bolstered by equipment deliveries and in August joined American Airlines for the first time in more than 50 years as total passenger service under TWA. TWA will make its bid with increased Lockheed Model 109H services added hourly toward first class luxury American, the only leader in nonstop service, will stand out with its DC-7 fleet until the Lockheed Electra again is 1970.

► **Olds** are increasing against any possible Trans World Airlines purchase of British Britannia turboprop airplanes. TWA technical delegations who recently visited British's plant was disappointed with the firm's production capacity and worried about the maintenance problems involved in the air frame and jet engine.

► **Capital Airlines** organizational structure has remained unchanged since David H. Baker took over the presidency three months ago (AW July 29, p. 38). Baker, former director of procurement and production for USAF's Air Materiel Command, has spent much of his time traveling around the company's various and studying its operational problems. Meanwhile, J. H. Carmichael, who was named chairman of the board at the time of Baker's election, has remained at the helm and continues to direct policy and overall operations of the carrier.

► **Passenger complaints** against airport restaurant facilities are beginning to mount as the result of overcrowded conditions and poor quality of food at a number of airports. Chief targets are the temporary terminal at Lufthansa, Chicago Midway and San Diego's airport restaurant which is normally considered to operate at most times with local airline employees. Among the bright spots along the air routes are Indianapolis, Pittsburgh, Cleveland and Milwaukee.

► **World Series** charter business was split between American and United Airlines. American flew the Milwaukee Braves to New York for the last two series games and then transported their back to Milwaukee in a DC-7. United Airlines, has spent more of its time United Airlines for both team plus newspaper, radio and television managers back to New York for the series back to five DC-7s.

► **Heavy demand** for airline businesses in New York for World Series customers forced temporary shutdowns at the last time. Lufthansa, American Airlines reported super-saturated baggage delivery and pickup service. Carry didn't have enough vehicles left after supplying World Series demands to handle the business.

► **Adrian** is using a conversion program for General Motors and 440s fitted with its 3,718 cubic inch 13113 turboprop engines. The company will use a General VC 115C transport it has on hand from the Air Force for development of this project.

► **Large increase** in international irregular airline operations has caused CAA to request a change in legislation that would require all carriers, other than the CAA, to determine the need of a carrier or sub-agent as to new members on flights outside the U. S. Under the proposed rule, sub-operations will be used where radio telephone communications cannot be accomplished and navigators will be required where accurate navigation cannot be achieved from the pilot's studies under normal operating conditions by means of visual or navigational navigational aids.

► **Civil Aeronautics Administrator James T. Pyle** has warned that more "began" parts fabrication are "contaminating" their products with the prime manufacturer's parts number is an attempt to peddle substandard parts as the original product. Others have been known to imitate the original manufacturer's packaging for the same purpose, he said. Some logic parts are almost impossible to detect without extensive testing.

POWER

**for new aircraft...
in whatever form it takes—**

Few activities in aviation today exceed the significance of new developments in the power plant field.

Among these developments are the mighty J-75 turbojet, now in production for big commercial jet transports and a number of very high performance Air Force and Navy combat aircraft... advanced, still-secret turbine projects... and entirely new engines of the future.

To meet the technical challenges these

developments present in every field of science and engineering, Pratt & Whitney Aircraft is backing more than 30 years of engine experience with the industry's most advanced privately-owned research and development facilities.

In whatever future form aircraft power takes... in new materials, new fuels, or even entirely new systems of aircraft propulsion, Pratt & Whitney Aircraft will continue its leadership in aircraft engine design and production.

NEW ENGINEERING FACILITY—To help meet essential engine research tasks a new Pratt & Whitney Aircraft engineering development facility is already in partial operation on its 7000-acre site 1.7 miles northwest of West Palm Beach, Florida. Major Air Force, Navy and other projects have been assigned to the facility. This is an artist's sketch of the new plant.



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VISCOUNT 810-840

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Faster New Viscounts will have a cruising speed of 343 mph. By 1958, more powerful Rolls-Royce engines will be available for conversion to a 400 mph Viscount.

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New Viscount: New Viscount can carry full payload up to ranges of 1380 miles (2480 miles with "Hopper" tanks).

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These Airlines Have Ordered the Viscount 810/840s:
 Comair Ltd., Air Lines, British Airways, Eastern Air Lines,
 Eastern Air Lines, Continental Airlines, Eastern Air Lines,
 TWA, Eastern Air Lines, Eastern Air Lines, Eastern Air Lines

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Dallas Air Terminal Stresses Comfort

By Craig Lewis

Dallas-City, of Dallas will celebrate completion of a major part of its \$15 million expansion of Love Field this month with elaborate Viscount-style ceremonies.

In a week of festivities, Dallas will inaugurate its new \$15 million terminal, a sprawling, eight-story, open and not looking that is the central feature in its expansion program that is virtually remodeling Love Field.

The program is striking evidence, if not a model, that Dallas intends to stick with Love Field as its permanent center for civil aviation services. Along with the terminal, a new tower, and taxiway, and a new building and other airport and maintenance facilities.

But the biggest thing in the program is the new terminal and it is about ready for the airlines to make the switch from the old, craggy terminal that has served the airport since 1949. Airline service at the new terminal will begin shortly after the inaugural celebration.

Convenience Emphasized

New terminal was designed to avoid one operation from a number of angles but passenger convenience and comfort was obviously a prime consideration.

First industries of the design philosophy comes in the 1,750 sq ft ticketing lobby. A 1,115 sq ft ticketing lobby reaches out into the lot to protect the passenger from the elements as the rest from the terminal. Passengers can park in the lot to drive up to a door in front of their preferred airline ticket counter.

Ticket area is entered through an automatic door and it is the lot door the passenger immediately will be leaving the gate for his airplane. Inside the ticket lobby, he drops his baggage when he checks in. It goes directly through au-



ARTIST'S conception shows completed terminal, parking space, for 1,750 cars.

line offices behind the ticket counters to a loading area on the roof level, then to the people's flight.

The ticket lobby provides 160 ft. of counter space for the six passenger airlines that serve the airport. Ten feet of counter space rapidly turned to Texas American Airlines before it could operating is now being held for any new airline that might serve Love Field.

Space for New Line

Provisions for extra counter space and gate space could be important since Dallas is expected to get new, competing lines in the West Coast or the Dallas-to-the West Coast, and this could mean a new airline moving into Love Field.

Both in the ticket area and the gate lobby, airport authorities here provided for easy expansion when traffic increases. Then again the new terminal will easily handle the traffic.

traffic capacity of the airport whenever it might be needed.

From the ticket area, the passenger enters into a spacious lobby that provides 27,750 sq. ft. of floor space, compared with 5,000 sq. ft. in the old terminal. Shops, rest, restaurants, rest areas and loading bridges all open off this central lobby area since its design was created the passenger to be able to stand in one place and find anything he wanted without need for explaining.

Above the lobby is a mezzanine rest area which is accessible by stairs, escalators or elevators. A passenger with time to kill can see the small lounge from the mezzanine, or he can go a door to sit in theater-type seats in the upper mezzanine and have a panoramic view of the airport.

Dressing Room

Large rest room facilities off the main lobby include restrooms where, in 50 rooms, passengers can rest a dressing room complete with tub and shower. This reflects the penchant of the terminal's designers for providing sufficient rest rooms.

There have been especially need to build a number of these rest rooms at the design of the terminal for the convenience of passengers.

Loading passengers proceed from the lobby through a single entry into the three loading bridges. The three bridges are marked with different colors, and flight attendants will direct passengers to a gate number and take for easy identification.

Public address system has been placed to avoid overlapping. All at least routine flight announcements will



PHOTOGRAPH depicts actual details of construction of the terminal.

be taped by a professional seamstress to give them a uniform look.

At the beginning of each finger lies the only bank from the designers' determination to keep all traffic flows on one level. There is a hump at this point to accommodate tunnels under the finger. These tunnels give the smaller ramp vehicles easy access to all parts of the ramp area.

Moving Sidewalks

The strain of climbing these beams is relieved by running sideways for both capturing and deploying passengers that come from between the entrance to the finger and the fast rate platform.

The three fingers provide gate openings for 35 transponds of DG-TC; and, then, can handle larger numbers of smaller transponds. Present terminal has 16 gates. The terminal is air conditioned from jacket coaters to loading gate. Air conditioned area includes 19 gates; center finger has seven gates for railcar traffic that are protected from weather but not air conditioned.

The fingers, along with the landing pads, scroll mouse and telephones, provide considerable operational space for the workers. Office space runs down the sides of all the fingers, leaving only a short open area to the gates. Some workers will provide lounge facilities at

Disposing passengers pass through the lobby into a separate baggage wing where their luggage is unloaded from many tracks into a conveyor system that places it where passengers can retrieve it themselves.

Terminal building was designed to facilitate maintenance work and to keep it out of sight. Canals in an area over the lobby area and an elaborate system of tunnels under the terminal will allow crews to do most house-keeping out of sight. Cleaning problems have been caused by widespread use of moprooms and tile.

Control tower in the new building is eight stories high. Top three stories will be occupied by Civil Aeronautics Administration and Weather Bureau facilities. The CAA tower will not move from the old terminal until spring is over to avoid disturbing order and traffic control system during the winter's peak season.

Amerson, Delta Rental and Contracting Inc. is a \$1 million underground parking system that carries traffic from storage tanks to each of the 26 gates. Ultimate delivery capacity is 25,000 gal per hour. Current storage capacity is 600,000 gal, and this will eventually be expanded to 1.5 million gal. Service will be operated by Allied American Fueling Company of Tulsa.

Rampage Expansion
Along with the new terminal, Delta is spending \$5 million to expand runway taxiways and other ground facilities. Instrument runway (NW/SE) is currently 7,750 ft long and the N/S runway is being lengthened to 6,000 ft. New taxiways and ramp areas have been laid to service the new terminal and ground support system.

Della grotta C&V

But Lone Field is ready to handle two-way transport operations. Applying constant factors, the effective length of the embankment runway is 5,512 ft., and Dallas authorities say this will be plenty for a transport of the Boeing 707 type since the most distant point a jet is liable to strike is Seattle, about 1,200 mi. away.

If more length is necessary, the instrument runway can be extended to 8,500 ft. within present airport boundaries. When traffic warrants it, possible in 3-5 years, a second instrument runway will be installed parallel to the

AVIATION WEEK, October 14, 1987

MICRO SWITCH . . . FIRST IN
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New MICRO SWITCH "ROCKET SWITCH"...
small, rugged, sealed, operated by the rocket
as indicating or lockout device *

*A new development
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Engineering in
cooperation with
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—900 v. max. Electrical Inco. 25 v. rating at sea level; around
24 v. approx.; positive 4 v. approx., inductive 2 v. approx., series 4 v. approx.
25 v. rating at 150 000 feet; around 24 v. approx.; positive 4 v. approx.,
inductive 2 v. approx., series 4 v. approx. (All ratings established
with and deliberately loaded.)



Rugged construction insures reliability of EN Series environment-proof switches

The second series Type 4224-4 (shown) is a rotary actuated, positive drive switch for linkage type actuator. Because there is no return spring the driving mechanism must control shaft movement. This positive drive ensures a distinct and reliable under the most adverse environmental conditions of use and dirt.

MICRO SWITCH HS switch has a true hermetic seal to insure constant reliability.



The switching element is tested in a gas filled chamber. This has been evacuated and filled with dry inert gas under pressure. Condensation of moisture from the switching chamber is prevented by heating in place. The switch is operated by a "wobble drum" actuator. The switch shown (type 1041) is qualified to 100,000 cycles. All elements are also available with other lever and leaf actuators.

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16.83 cu. volume force—4 wt. gals. Overhaul—
Revised level—125 in. max. Weight—1.5 cu.
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Twenty-five years ago the DC-1 set a transportation record of 11 hours and five minutes was headline news — today it is the standard history of the "Good Old Days" of aviation. Set even in 1935, Rockbestos wire and cable had created a proven service reputation.

Today, Rockbestos can look back on 25 years of developing and manufacturing quality wire and cable and a long history of close association with the aviation industry.

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ground nearby, but 3,000 ft. away, on the opposite side of the terminal Dallas was most of the land now for the second runway, and until it is added the program brings in about 5,000,000 a year in rentals.

Construction of the new terminal caused considerable disturbance of commercial facilities at Love Field. Renell's old headquarters building had to be moved, and the company has moved its general office to the new Renell Building in nearby Exchange Park. Southwest Airlines' service facilities were on the terminal site, so the company moved across the field to a new site.

Renell Area

Renell's present construction line is adjacent to the new terminal, but it will cross across the field when the new Renell base is finished and used. When the old base is moved, more airfield facilities will be built to supply what already overcrowded spots in the new airport terminal.

Completion of Love Field's new facilities has also emphasized another fact Dallas intends to stick with its present airport and expansion it is a modern airfield traffic hub. And it is convincing proof that the question of sharing a runway airport with such long as Ft. Worth is completely dead.

Dallas and Ft. Worth have squabbled bitterly in the past over the airport issue. Ft. Worth has argued that the two cities should share Texas Center Field, built midway between them because it is safer and would be more convenient than supporting two airfield terminals. Dallas pointed out it wouldn't have its citizens go halfway to Ft. Worth for airline service when it already had an airport only five miles from downtown.

City Renell

The argument has simmered down in the past few years as relations between the two cities have been guided by agreement. Now the issue is nearly confined to Ft. Worth's complaints that the airlines don't furnish adequate service at Center Field and Dallas' contention in CAA cases that American favors Ft. Worth in its scheduling.

Dallas cites construction as a major element in its decision to develop Love Field. The new terminal is a little over five miles from downtown Dallas. Since about 75% of the air travel out of Dallas is business travel, time and convenience are important considerations. Love Field is also convenient to the north Dallas residential area where the airports of all its businesses live. Answering objections to the safety margin in its support on the matter of a heavily settled area, a Dallas official says the city feels that any successful airport will attract development to its

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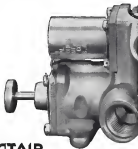
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one, so there would be no permanent benefit in saving.

Current development of Lone Field follows the basic plan laid down in a master plan adopted in 1943. Financing for the project has come from a series of bond issues. The \$7.5 million terminal was paid for with general obligation bonds, and \$5 million worth of ramp, taxiway and runway work was financed by revenue bonds which rely on gate airport revenues.

To help construction expenses, Delta financed construction with \$10.5 million of revenue bonds but to finance from long-term loans. Southwest Airlines got \$3.5 million to help build its new server base. Southwest Airlines is also leasing the old terminal building.

Delta also allotted \$5.5 million in bond financing for the new Bonifield maintenance base, \$1.2 million for Delta's base and \$1.3 million for American's new facility.

Financial Status

Lone Field has been in the black as an operating base since 1961, and income covered debt service also in the 1962-64 period. As more bonds were sold, debt service covered operating costs, and it will be covered more by debt income will cover debt requirements again. For the first year ending September 30, 1965, income is estimated at \$2,409,500 and operating expenses at \$1,250,167.

Work being completed facilities will begin with an open house for employees October 20 and last through as open house for the public October 26-27. Commemorative will include a dinner honoring business and civic leaders, a program day and a national press preview.

Highlights of the celebration will be a speech by Civil Aeronautics Board Chairman James R. Dorian at a lunch, one for school children and a salute given by Civil Aeronautics Administration James T. Pike at formal dedication ceremonies.

CAB Awards Routes in Phoenix Decision

Washington-New and improved air service from Phoenix to Denver, Salt Lake City, San Diego and Los Angeles via Palm Springs has been approved by the Civil Aeronautics Board. The service will be provided by Bonanza, Frontier and Western Airlines. In the Service to Phoenix area, the CAB decided that:

• Western Air Lines is authorized to provide service over a new segment between the terminal point Denver, the intermediate point Phoenix, and the terminal point San Diego, subject to



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types of civil and military aircraft to be operated and accurate traffic control requirements needed to handle the expected traffic safely. In this case, the firm will use Leados & Brown, Cincinnati, Ohio, Assistant of Research Foundation, Cambridge, Mass., Airborne Instruments Laboratory, Mahwah, N. Y., and Cornell Aeronautical Laboratory, Ithaca, N. Y.

During its last session, Congress appropriated \$12.5 million to begin construction of a second airport in the Washington area.

No funds from this appropriation can be spent, however, until the President reports to Congress upon the submission of a bill. The report is due in Congress by Jan. 15. Quander's report will go to the President by Jan. 1.

Quander said that, after all possible sites have been reviewed in the last two or three, public hearings in each community involved will be held to determine the impact the airport would have on the community.

North Central Given New Midwest Routes

Washington—North Central Airlines has been authorized new routes between Duluth-Superior and La Crosse, Wis., and routing service between Duluth and Chicago by the Civil Aeronautics Board.

At the same time, the Board withdrew Northwest Airlines' authority to serve Duluth-Superior, Green Bay, Wis., Eau Claire and La Crosse, Wis., and has not acted thereon for the last several years.

In its final decision in the Duluth-Chicago Service investigation, CAB found a need for improved Duluth-Chicago service but said there was no need for the services of both North Central and Northwest. CAB also said North Central now provides substantial frequencies of service at the stated Wisconsin cities which Northwest does not seek to serve, and that there is no need to continue authorization at these points.

Because of the isolation and serious lack of rail and water transportation facilities in the Upper Peninsula of Michigan, the CAB decided to authorize North Central for this service for a period of three years. Ironwood, Houghton-Houghton and Marquette will be served on this route.

North Central also was authorized to provide connecting service between Duluth and Chicago via Madison and two stop service between the two points via Milwaukee and Green Bay.

Northwest had asked to coordinate its service from the Twin Cities to Duluth or to provide an interchange service with North Central.



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Eng. U.S. Pat. 448

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AERONAUTICAL ENGINEERING



LITTON'S Hanna, Le Vardine and Stephenson (left to right) are grouped around inflated suit in high vacuum chamber.

Laboratory Simulates 95-Mi. Altitude

By Irving Stone

Recently **TRK, Calif.-Utah** installed high-vacuum laboratory was unveiled here by Litton Industries, designer of the research tool, with the announcement that the vacuum chamber with an experimental mode had been able to simulate 95-mi.-altitude pressure conditions.

Engineers at the laboratory originally was unveiled in Aviation Week (Oct. 22, 1956, p. 31), which also revealed a pressure record run to 90 mi. altitude (Aug. 12, p. 38).

Sponsored by AFOSR

A fundamental tool for gathering research data for ultra-high-altitude systems by direct mass-controlled experiments within the chamber, the facility had associated program is sponsored by the Power Office of Scientific Research, Commanded by Brig. Gen. H. F. Goggin, and sponsored by OSR's Directorate of Advanced Studies, headed by Dr. Morton Apley.

Laboratory will be used to advance knowledge on physical phenomena and behavior of equipment and instrumentation under low pressure environment encountered in space.

High altitude areas which can be replicated include:

- Action of lubricants in atmosphere

environment, where corrosion takes on known to operate.

- Operation of sliding contacts and other mechanisms where friction phenomena is altered in absence of air-borne particles.

- Reaction of materials, components, protective equipment to X-rays and other solar rays filtered through cloud layer profiles.

- Effects on behavior, physical structure, fire rating and other factors of heat treatment of equipment parts, thus saving valuable time by direct extrapolation of unheated test articles to the evacuated chamber.

In addition to these example applications the facility can be applied to a broad field of development where ocean conditions are part of the basic research. It will allow a specialist to be brought directly into the environment where he becomes part of the equipment.



SIGMOND HAGEN, Litton's director of research, models out.

direct extrapolation of unheated test articles to the evacuated chamber.

In addition to these example applications the facility can be applied to a broad field of development where ocean conditions are part of the basic research. It will allow a specialist to be brought directly into the environment where he becomes part of the equipment.

Chamber Advantages

His observations can be translated into direct alterations of test equipment rather than depending on remote control, which is threatened. It will allow loss in immediately observable phenomena and get first-hand data on accurate changes. Big economic advantage is found where the experiment is not repetitive and such an estimate cost to set up a unit.

Estimate of average cost for running an inflated chamber test at \$125 per hour.

During demonstration of the high-vacuum chamber, the test started at an initial altitude of 37 mi. But the height had to be reduced because of slight damage to the anti-leak coating on the special Litton-designed unit which the subject wore. Subject demonstrated that he had good visibility, good dexterity of fingers and stability of arms. Litton claims it is the

only garment which exists today which affords this degree of mobility under these experimental conditions.

Aluminum components, used usually in the upper part of the garment, are included in numerous fittings.

Garment Construction

These garments made of submersed nylon, weighs about 50 lb., and is called a modified USAF ventilating suit. This submersed nylon suit is subject to some gas leakage and volatilities and is covered by a rubber latex liner to prevent these effects from being transmitted to the chamber atmosphere. Drops in the suit are also covered by a similar rubber sheet for the same reason. This rubber sheet material has not been used for the suit proper because it is not as strong as the submersed nylon. It is cheaper to replace a sheet than it is to build a suit of this material and replace it as it deteriorates.

Suit is designed to allow breathing and removal of body heat. Both these functions are oxygen and are accommodated by using a single system rather than using a system for each, which would create a difficult problem of insulation. Oxygen used for breathing is very little in comparison with that used to remove heat. After heat removal cycle, the oxygen is returned for re-use.

No Response to Date

Time needed to be desirable to bring chamber and subject down to sea level is 10 sec. The low level test sometimes and demand to be satisfactory. No operation to date has required any emergency features in procedure.

Oxygen is piped into the suit at 5 psi absolute. This keeps the subject at an approximate altitude of 27,000 ft., but instead of air he is breathing pure oxygen. Subject can stay at this altitude for various lengths of time depending on the type of work he performs.

Aviation Week has learned that during the 95-mi. record chamber run, the subject, Brigadier Hanna, Litton's technical director of research, was at this altitude for approximately 15 hr. Other Litton staff members who have participated in chamber runs include Alvin De Vardine (who was in charge of test design), Nick Jones and Rick and Askey. In the chamber, the subject can use hand tools such as screwdrivers, pliers, etc., power tools such as a drill and perform such gas welding. He can pick up a ribbon-cutting electron gun which can be used as an appreciable source of energy. It can be used in various applications to heat away surface (fusion) gases, and can also be used, with its insulation action, to detect small leaks in the chamber.



ALUMINUM upper part of Litton suit is fed oxygen through modified hose. Rubber sheet has been removed from suit to expose submersed nylon portion. Sheet of submersed nylon, hole at left can be right for oxygen, it operates in vacuum. Test permits scientist to enter chamber to adjust research equipment.



SUBJECT manipulates new device on equipment in chamber. Thick cable attached to overhead hoist will support him if he falls for any reason. Safety measure is designed to avoid swelling of her pleat. But convenience means safety.



10 YEARS BEYOND THE SONIC BARRIER



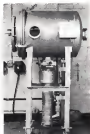
Aviation history was made on October 14, 1947 when the Bell X-1 reached a speed of nearly 700 mph. Man had broken the sound barrier for the first time!

The rocket-powered X-1 also opened the door to a decade of significant advances in high-speed, high-altitude flight. A few years later the Bell X-1A, successor to the X-1, set a new speed record of 1,650 mph and a new altitude record of 90,000 feet.

Then, still working in conjunction with the U. S. Air Force and the National Advisory Committee for Aeronautics, Bell pioneered the X-2 which reached more than 2,000 mph and 70,000 feet... the fastest and highest that man has ever flown.

Never intended for tactical operations, these experimental aircraft made invaluable contributions to aerodynamic design and the art of supersonic flight. They left their marks on the airplanes of today and tomorrow and blazed the trail to the supersonic age.

Today, ten years after the first flight beyond the sonic barrier, the team of Bell engineers responsible for the famous series of X-airplanes, is working on even more advanced aeronautical concepts. One of the more challenging of these is an aircraft which will combine the ability to take off and land vertically with the high speed and performance of a conventional jet.



SHOCK test chamber was used to shock and test chamber parts before design tests.

or in pressure-sealed devices used in chamber experiments.

Facilitates Manoeuvre

The unit is designed to avoid change of volume as the subject moves. This makes later manoeuvre free to accept like objects, with only the burden of moving the test piece. Set is used on subject's shoulder to permit fatigue.

A slack cable is attached to the seat from an overhead track as an emergency precaution to prevent the subject from falling from any cause and thereby ruin the test. J. is Plexiglas transparent. Unaltered, the chamber has been

Chamber Contrast

Original AFOSM Litter subject and facility risked the inherent high vacuum laboratory. This was created to include fabrication of the facility, assembly, development and testing. Test cost of bringing this facility to operational status has been about \$600,000. This contract has now been completed and Litter is not under AFOSM contract at the time. It is anticipated that AFOSM will extend Litter contracts for various research projects, which probably will be in the field of physical research and not expected to encompass sequential research recently completed under direction of other agencies.

Litter also is anticipating entering into contracts with other agencies and companies covering various phases of high vacuum studies. Such contracts will require AFOSM approval for use of the government-owned facility.



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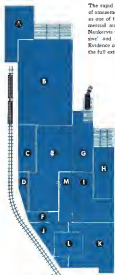
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DOCTOR in long-waisted isolation suit looks through viewing window during operation, pulse of test system.

taken to an altitude of 140 mm. Instruments already inside may permit it to be evacuated to correspond to an altitude of about 168 mm.

Vacuum chamber proper is 8 ft. in

diameter and 14 ft. between end bells. Volume is approximately 700 cu. ft. Wall is 3/4 in. hot-rolled steel plate. Portholes on the side permit viewing by outside observer.

Pumping Requirements

Two pumping systems are required to obtain the very low pressures. A roughing pump is used to bring pressures initially to somewhere between 0.1 to 1 mm. Hg. Beyond this point a 12-in. diameter oil diffusion pump is used.

Positioned just in front of chamber is duct to an emergency let-down system.

Littion is not concerned with aeromedical aspects of high altitude measurement but it does have flight simulator closely all runs made with the chamber. These medical runs include Dr. John H. Popper, Capt., Medical Corps, USN (Ret.) and Drs. Francis Dumas and Bruce Lessor of University of California, Los Angeles, Medical Center. Dr. Lessor was in attendance during the public demonstration run. Sufficient data is obtained to determine that the subject in the chamber is in safe condition. Instruments at its end station record such factors as heart action, blood pressure, respiration etc.

In addition to medical observation, another outside station is manned by a systems controller who, in addition to

keeping visual screen to the chamber through a porthole, can check carbon dioxide, temperature, humidity, oxygen flow rate, etc. A pumping controller scans a fluid system.

Administrative director of the Littion isolated high vacuum laboratory is Albert H. Stephens.

Light Lithium Alloy Still Strong at 400F

Use of lithium in aluminum alloy produced a new aluminum alloy which maintains high strength up to 400F, according to a recent announcement of Alcoa, Pittsburgh, Pa. New X2030 aluminum-aluminum alloy will raise the Mach number level for aluminum from Mach 2.0 to Mach 2.5.

Alcoa said that its extensive research with lithium indicated that the new alloy would retain its strength at high temperatures, but also produces an unusual increase of the modulus of elasticity.

Because lithium is so light (it will float on water) the resulting X2030 alloy is more than 1% lighter than pure aluminum aircraft alloys. Though there were many obstacles to melting and casting a sound ingot, Alcoa said that all mill problems of this alloy had been solved in standard fabrication.

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VULCAN wing tanks are fueled from pressure fillings in which wells. System includes fuel umbilical, fuel root wing tanks on each side.

Vulcan, Going to Squadron, Escapes Usual



VULCANS score down the Avon production line. Ribbed leading edge of the wing is noticeable wherever the NACA's contour studies show clearly on plane in foreground.

Waddington, England—RAF's first operational squadron equipped with the delta-winged Avon Vulcan has completed its conversion here.

Crews of No. 93 Squadron, Bomber Command, have taken over the big white delta from instructors of No. 27 Operational Conversion Unit. Three weeks before the squadron completed its training, it sent four out of the six trophies to Bomber Command's 1917 teaching and navigation course here.

Three crews selected from both units now on this duty will compete against USAF Strategic Air Command crews in bombing, navigation and reconnaissance trials Oct. 14 to Nov. 5 at Pacific Pacific.

Three other RAF crews in the competition representing Britain will use Vulcan Vulcans drawn from the full squadron strength of No. 5 Group of Bomber Command.

Vulcan B Mk. 1 Delivered

Current deliveries are Vulcan B Mk. 1 versions pressed in four Bristol Gloucester 104 turbojets rated at 15,600 lb. thrust each without afterburner. First deliveries to the RAF began in mid-1916 with planes sent to No. 33 OCU at Waddington.

No. 93 Squadron started getting its Vulcans this year.

Service Vulcans now have racked up more than 1,000 hr of flying time.



HYE-MAN crew enters Vulcan (left). Door does not blow off, but drops to platform back. Vulcan fly over Washington (right).



'Teething'

enough to develop one of the bags that usually plague new aircraft entering squadron use. But the RAF says that airplane has had fewer teething troubles than any other they've received in the past decade.

No single Vulcan has developed trouble that kept it on the ground more than two days, and there have been no runs ground-up.

Later versions of the Vulcan will be designated B Mk. 2 and will use a new wing designed to improve both altitude and speed performance. Powerplants will be Bristol Olympus 300-series turbojets rated at 16,800 lb each without afterburner.

Expected defense armament for the Mk. 2 will include an anti-aircraft missile being developed by Avon's guided missile group.

Vulcan Crew

Normal crew complement is first, first and second pilots, plotting navigator, bombing navigator and electronic officers.

Each airplane has its own crew chief, a technician position in air forces the world over.

Crew selection for the Vulcan parallels that of USAF assignments for B-57 crews. Top assignment in Bomber Command now is to be first pilot of a Vulcan. For that job, a pilot must have a minimum of 1,750 hr flight time as a first pilot, plus a total of duty



INSTRUMENT LAYOUT (top) includes indicator giving pilot read position of deflection on trimmer, altitude and electronic (top instrument above console). Rpm., set at 6,200 a less than cruise for Olympus engine. Two structural doors open for engine access (below).





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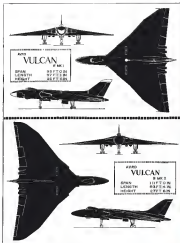
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*Eugene W. T. Piper, Pres., Piper Aircraft Corp.; Gene Allen F. Edwards, Jr., Manufacturer's Representative, Detroit, Mich.; Veteran Pilot Jack Grimes, seen on "Wings and a Prayer" (ABC-TV); Service Manager E. E. Schubert, Cigarette Aviation, Inc., Rochester, Mass.

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in Canberra. Forward-segment engines are desirable, says the JAF.

Second pilots need 730 hr. as a first pilot in that category, plus a Canberra tour. Navigator must have completed a tour with Canberra also, and the bombing navigator must have gone through the one-month's training school. Electronic officers must be expected to have completed duty with other bombers, transport or mixed command. Ground crew are all volunteer air men who have gone through the JAF technical college plus the air mechanics school.

crew Training

Training course at an operational command start working up to Vulcan duty lasts 12 weeks. First phase for pilots is a four-week ground school on the Vulcan and its systems, primarily concentrating on flight planning and cruise control.

Second pilots specialize on such systems as they operate during flight-tack-

eter presentation, personnel. A similar course applies to navigation and electronic officers in their specialties. Flight simulator time begins near the end of the first phase of training. Pilots get 150 hr simulator time before actually flying the Vulcan and a further seven hours after flight checkout.

Variable Lighting

One different feature of the simulator is that the nose target is simulated in a shell that has variable lighting. These lights can simulate external automatic atmospheric lighting from bright high-altitude daylight to dark or moonlight night.

Two additional weeks of ground school start off the second phase of flight training, and during this period, the first bombardment flights are made on the Vulcan.

In words of someone flying in the airplane simulator the course, "There begins with two hours of high-altitude

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Enclosure: Send me Technical Manual Manager for employment data.



George A. Phillips, manager, with General Electric's advanced constant-speed drive: left, 750-hp, 10-KVA hydraulic constant-speed drive

and generator settings. Right, 115-hp, 10-KVA turboelectric generator and high-speed alternator on a common shaft.

How to Choose the Right Constant-Speed Drive

General Electric engineer outlines method to help determine which constant-speed drive—hydraulic or air-turbine—best suits requirements of particular aircraft

By George A. Phillips, Manager

Turbine Engineering, Aircraft Auxiliary Turbine Dept., General Electric Company

Providing a source of adequate, precisely controlled air power—with minimum air craft performance penalty—is a challenge to the aircraft designer. Electrical loads continue to increase, yet refinements require lighter, smaller, simpler-to-operate power systems with automatic fault protection.

Today, engineers are recognizing the increasing importance of the power drive, and looking closely at the comparative advantages of hydraulic and air-turbine drives.

Both hydraulic and air-turbine drives are reliable, efficient.

In general, there are few differences in performance between the two types of drives. Both hydraulic and air-turbine drives offer aircraft a reliable source of constant-speed power. To get optimum performance from a particular aircraft, however, the relative merits of each drive system must be carefully matched to the requirements of the plane. . . its mission and power plant characteristics, temperature environment, space and weight



LOCATION IS ONE CONSIDERATION Hydraulic drives can be mounted directly on engine cases or used with generator (left). Air-turbine drives can be located on engine or by using an auxiliary drive (right).

limitations, and reliability.

To help aircraft designers select the drive system that will give their planes the optimum performance, General Electric's Aircraft Auxiliary Turbine Department offers assistance in each of the following steps in the selection process:

1. Establish aircraft drive system configurations.

Turbine drive system layouts depend upon an analysis of plane configuration, power plant, accessory power needs, and mission including starting and ground handling. . . . Often apparent early in the aircraft design stage.

At General Electric, aircraft configurations will be prepared by a group of engineers with broad experience in the design and application of both types of drives, plus a knowledge of electrical system coordination and protection.

2. Study boundary conditions and size constraints.

Drive system boundary conditions include the input from the power plant, characteristics of the power distribution system, loads into which output is fed and environmental conditions with particular reference to heat dissipation and cooling. The system engineer includes a thorough evaluation of these boundary conditions and their effect on the design of accessory power system components. Overloads and full starting loads imposed

by the electrical system, for example, must be matched by a drive which will deliver this output under all required engine operating conditions.

Calling on the IBM 704 computer, General Electric engineers determine maximum fault torques in terms of alternator sequence impedances and type of excitation system. This simplifies the problem of determining the best safe compromise between minimum voltage performance with substantial phase loading and fault current capability on the one hand and drive and engine penalties on the other.

3. Analyze weight penalty of each drive.

After the several system configurations have been defined, total weight penalty—system's installed weight plus weight of fuel necessary to compensate for power extraction—can be chargeable to system—then because no important comparison basis for drive selection.

To assist the aircraft manufacturer in this phase of the selection process, General Electric systems engineers team up with computer technicians to deliver facts and figures on both drive systems. Reported accessory performance, such as mass flow, load demands, response and engine performance, and weight of system components are some of the factors which may be programmed into the IBM 704 electronic "brain."

4. Consider system requirements.

Choice of a system extends beyond quantitative investigation. Special considerations—starting and maintenance, unusual operating requirements, number of power plants and drives, effect of related starting and air conditioning systems—must be studied carefully. Operating advantages obtainable from each type of system must be evaluated and matched with the particular application before the best drive can be chosen.

... and after the right drive is chosen . . . Developing the prototype, and translating it into proven production models, are tasks that call for broad experience and modern facilities.

Today, at General Electric, constant-speed drive engineering and development facilities—13 test cells, 64,000 sq. ft. of development floor space, 501,800 sq. ft. of production floor space—are combined "under one roof" at G.E.'s Lynn, Mass., plant. This integration entitles technical know-how and product certainty and adds up to one more reason why General Electric is qualified to help ensure that the right choice is made, and the right drive produced.

For more information about specific products of the Aircraft Auxiliary Turbine Dept., check with your nearest G-E Aviation or Defense Industries Sales Office. General Electric Company, Schenectady 2, N. Y.



ANALYSIS performed in early design stages by General Electric engineers is later programmed in IBM 704 computer to help customer select power drive system that best meets requirements of aircraft.



QUALITY REQUIREMENTS of drive components are carefully matched with equipment and throughput facilities sq. ft. of production floor space of G.E.'s Aircraft Auxiliary Turbine Dept.

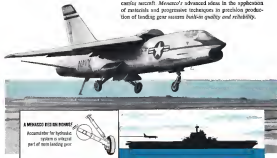
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CHANCE VOUGHT record-breaking Crusader jet fighters require extremely rugged landing gear to operate from aircraft carriers. The design for the main and nose gear called for great strength in order to absorb maximum sink speeds and arresting tension; the weight-saving combination of steel and aluminum; and the highest mechanical specifications.

MENASCO was chosen to fabricate the Chance Vought Crusader landing gear and not only met but exceeded all requirements. The gear is the lightest, strongest and most compact of any carrier aircraft. Menasco's advanced ideas in the application of materials and progressive techniques in precision production of landing gear assure built-in quality and reliability.



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flight to demonstrate landing characteristics, followed by a series of landings.

First maneuvers followed, and then came emergency procedures. The trainer captain with his own second pilot taken over the control role in the third exercise.

Total course flight time is 50 hr, and about half that is night flying. The course also includes flight time in Chaberski to develop instrument landing system approaches.

Longish Checklist

The complexity of a modern air weapon system is reflected in the length of the pilot's checklist. Before the engines can be turned over there are 108 items to be checked carefully. Those cover the obvious like taking off the covers to the engine inlet and exhaust or the saddle. The checkout of the engine gas by the electronics officer.

To start the engines is a 10 step procedure. Before taking the list includes another 27 points, and finally, the pilots run through a 21 item takeoff checklist.

Flight characteristics of the airplane have been singled out for praise by its pilots. All controls are prearranged with artificial feel from a system between the control column and the flying surface power units. Spring tension is varied with changes in indicated airspeed (Q force vectors). If the power lever is moved back with full spring force, there are relief buttons in the cockpit which relieve the tension on the spring so that normal forces can be obtained for landing.

Maneuverable Aircraft

Demonstrations of the Vulcan at Fort Worth have shown better task control of the flying qualities of the plane.

Ever spectators remember the time that Bob Felt, Avco's representative of flying, scored across the field and pulled the huge delta into an upward roll. Short takeoff and landing—advantage with the plane flying well below its normal gross weight—have been impressive.

Overall of the Vulcan is good to a 100 hr check period with the first major overhaul at 500 hr. Checkouts at the old landing hours are called major overhauls and those at the overhauls are called minor overhauls.

Volunteer R&F crews are used in the tests for ground crew members of the long training period and the desire to hold the race on the job as long as possible. Advanced grades of mechanics in the servicing crew take a course on the Vulcan at the test plant, and the lower grades are instructed at Wallops.

One of the most features of all



LOCKPORT PRESSURE GAUGE used in jet engine tests. The gauge has a 100 psi scale and a 1000 psi scale. The gauge is a 100 psi and 1000 psi scale.

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Bombardier squadron No. 617—known as the Ditch Busters—learn their agonies against the German water-bombers during World War II—is being refueled next year with Avco Valco. The squadron, disbanded last year and posted from every quarter, should get its Valco's soon and be ready as an operational unit early next year.

Bomb concept of the Valco, although now almost 11 years old, was advanced by it. Organized by the Air Staff and based on Jan. 1, 1947, the requirement called for an airplane with large bomb capacity, long range, the ability to cruise at extreme altitudes—no more than 60,000 ft—and to enter the bombing run at transonic speed.

Design Start

Avco's design team, under the direction of S. D. Davies, began the layout of a series of designs to meet the specifications and eventually decided on the design layout as being best suited. The same specifications were used. Davies produced a group of designs based on the so-called "concrete wing" concept, in which wing structure is increased in a function of type material. Davies and the present team com-

pleted their best design in the fall of 1947, and were faced with the problem of having no flight-test data to check on correct calculations for their Type 508 design wing bomb. So they turned to the development of a line of research aircraft, built to one-third scale, which would be used to develop as much of the proposed flight envelope as possible.

Experimental Design

Five of the little ditch-disguised Type 700—were built to various configurations and purposes. The first flew on Sept. 4, 1948, just making the firm through design that year. But it was lost in the air later and not until the next September was the second ditch-disguised to fly. It too just made the Fairbroughs show, flying in over the house late in the evening of the first day. That second ship was a 700 and had, like the first, a dorsal intake well behind the cockpit.

Third in the series, a high-speed 707A with wing and intake which were pointy-tail of the big bomber, flew in July 1951. Two of these configurations were built and flight-tested at speeds up to the transonic.

The bomber design, led by data from



Shorter Fin Tested on B-52

Vertical tail surface on fast ditcher than on production airplane is being tested on a B-52 at 125,000 feet. Success of the airplane's one-way landing gear pointed tail surface solution, with potential weight, drag saving which will improve range and performance characteristics in future production airplanes (AWM May 13, p. 28).

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the little delta, was completed in April, 1958, and the drawings were released for contractors.

Powerplants specified for the production airplanes were the two-spool Bristol Olympus, but the engines could not be used for the prototypes. Consequently, the first prototype was built around the throat of a quartet of Rolls-Royce Avon RA-5 turbojets, rated at 6,100 lb. thrust each, or about half the design figure.

Prototype Success

Underpowered and well below design capability, the first prototype 695 took off on its first flight August 30, 1957.

Tried by the little search delta, a few over the Farnborough display a few days later in the first of a series of successful flights at the place in successive years.

Fifth and last of the research delta, the two-seater 705G, flew in July 1, 1955.

It was designed and built for light reconnaissance.

Second prototype of the Type 695 was powered by four Bristol Olympus engines, developing about 9,750 lb. thrust each, well below their eventual figure.

The plane flew Sept. 3, 1953. Much time the first prototype had been re-engineered with Armstrong Siddeley Sapphire ASRs, 5 turbojets rated at 5,000 lb. thrust each.

Only other visible change in the second prototype was the addition of a virtual bomb-bay position, below the nose which has since been adapted or modified for the line.

Production Vulcan

First production airplane flew in February, 1955, and was followed into the air shortly after by the second.

These first four airplanes of the Avon line were of "pure" delta; that is, they did not have any modifications from that showed the lines of the oval, triangular plotters.

They measured 99 ft. from tip to tip, and 97 ft. from nose to tail. Overall height to the tip of the fin was 28 ft. 6 in.

These "pure" deltas ran into aerodynamic troubles, so have most of the triangular shapes designed so far. Bug-grip wires revolved around the ultimate performance, where the plane had to fly at high angles of attack, to develop the necessary cruise lift coefficient. At 60,000 ft., for example, the lift coefficient for the Vulcan at Mach 0.9 is on the order of 0.8, for a 40,000-ft. cruise altitude and a speed of Mach 0.7, the lift coefficient is about 0.6.

High lift coefficients cause high drag, due to lift (induced) drag and an additional increment of profile drag

due to the angle of attack. Clearly this drag had to be reduced to improve the performance of the Vulcan.

The drag reduction took the shape of a modified wing leading edge somewhat in the style of NACA's round crescent and on the Convair F-102-36 series and the B-58. That modification did several things: it increased the wing area a little, it reduced the thickness-chord into a little, and it increased the number of the leading edge a lot. The net result was that the induced drag component at high cruise lift coefficients was reduced to a more tolerable value, and the creasing of the airplane was also reduced.

The latched leading edge was flown as a refinement in the second prototype in October, 1955. It has since been built on all of the production airplanes.

Wing Change

Latest modifications modifications it what appears to be a completely new wing fitted in the second prototype and demonstrated this year at Farnborough. The Vulcan is an aerodynamic prototype for the B-58, a 3 production version, and like so many of the Avon delta before it, flew just before the Farnborough display but in time enough to make the demonstration.

This new wing is even more of a

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departures from the delta larant and began to resemble the 'narrow delta' parameter used on the Douglas F4D Skyray series.

Area and open have been increased the wing tips are of larger chord and rounded at the leading edges. The leading edge is extended and cambered.

Slight overbuck of the signal tracking edge has been observed beginning at about 40% of the span outward. The tracking edge shows what appears to be three separate and distinct degrees of deflection, but it is possible that the outward "deflection" is deceptive because of what appears to be a considerable amount of wing twist toward the tip.

Engine Test Bed

In addition to the already named pentetate B ML 2 and a standard B ML 1 production Valera from at Farmborough, Bath Road demonstrated a Valera used as a test bed for the Gamma-ray source in production for the Thales-Pire Victor.

The place was the original protest site as the fourth major powerplant change. And did the conversion, then, on Aug. 4 and delivered it to Ballymore at the company's Haddock fight development center on Aug. 24—once again in time to make a thoroughgoing double conversion.

Values of Bomber Command also rated over the field during the display emphasizing that the airplane is in service with the RAF. The Valiant is called the world's fastest operational bomber, primarily because it has indicated some speeds during test flights. In reference to Avco, the company has never said that the delta ever exceeded sonic speed.

Header Page: Preparation

Wanderlodge, however, has been plugging its line of "higher-faster-further" for the Victor for years and recently announced that the Victor had exceeded the speed of sound as a jet fighter. The company's stand at Hamburg further proved the point and the Victor was the biggest aircraft in the world to have done so. Postwar armistice clauses for the Victor's pilot installations were not exhaustive.

At Vidmar, Inc., in full production at Avondale, a large factory near Manchester, Mass., components for about one dozen ships are on the line at any one time, pending the photos recently available.

At Vidmar become available, they are to be delivered to squadrons within No. 1 Bomber Group, which will operate them and the remnants of the Castles which are still serving Bomber Command. No. 1 Group will receive the Handley Page Victor and currently operates the Vulcan. Victor



附一：附录一——主要参考文献目录（按作者姓名排列）

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DRY WEIGHT of 204-lb. Hercules Engine Co. engine is 515 lb. with starter and granules.

line, told **AVIATION WEEK**, "many organizations have tried to make an engine of this type but we know of none that were able to keep one running more than a few minutes before failure. It is possible that insufficient study of detail and lack of present application caused the failure. I think that we have nothing basically new."

Curtiss Negotiates License for Iroquois

Curtis-Wright Corp. and A. V. Roe Canada Ltd. confirmed that an agreement has been signed covering the rights for manufacture, sale and further development of the Iroquois jet engine in the U. S. as predicted in **AVIATION WEEK** (May 27, p. 21 and Sept. 9, p. 181). Curtiss intends to use the Iroquois in USAF interceptors, as North American's F-109, which are rejected to participate in soon as USAF "shakes down its new engine requirements."

Iroquois uses 1,500 lb. weight to develop 13,600 lb. thrust, without afterburner.

Visiting ADC Interceptors Assured Priority Servicing

Operation Paperion is name of program initiated by 20th Air Defense Division to assure fast turnaround and clearance of driven planes on an 8-hr. minimum that put down at least at Strategic Air Command, Air Force Command, Air National Guard or Air Force Reserve.

Participating bases have pledged cooperation in reducing ground time and providing prompt service for a 20th Air Division intercept fighter interceptors that is recovered near from its home base, Richards-Gebaur AFB, Mo.

It is hoped that Operation Paperion will cut ground time to a minimum and provide the urgent services essential to a visiting interceptor that may be required to scramble in a hurry.

The 20th Air Division expects that its combat potential and effectiveness will be increased by the program.



Dr. Hasan A. Fekris and Donald Mortimer discuss Gnomoscope system with Harold Street and Donald Mortimer.

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Lunar surface as seen through an astronomical telescope. The puzzle of what's on the other side may soon be answered.

World's oldest mystery soon to be solved

Ever since man has had the imagination to ponder any problem, he has wondered what lay on the dark side of the moon . . .

Now, engineers predict that rockets carrying cameras or TV will circle Luna within five years and show us her other face.

At Douglas Aircraft, where one of the first rocket and missile projects was set up in 1943, practical investigations have helped show the way to lunar circumnavigation. They have led to more effective missile guidance systems . . . helped establish basic principles of air-to-air rocket fire . . . led to use of such heat-resistant materials as titanium, ceramics, and plastics. Douglas engineers have investigated space physiology and psychology—how man will react in the weightless glare of space—and even investigated new kinds of power, engines that may use ions or light rays to reach the stars.



Waco Corporal, an early Douglas rocket, takes off in the race of a captured V-2 to set what was then a world altitude record. Douglas has since developed such weapons as Nike, the new Nike-Hercules, and the Army's potent Honest John, which can carry a nuclear warhead. Even more exciting projects—still classified—are going full speed ahead at Douglas.

Depend on
DOUGLAS



first in
Aviation



This view of Russian Bliznyak light bomber shows 55 deg. sweep of wings, outstagger leading gear pods at tips.

Soviet Blowlamp Compares With U.S. A3D



Soviet Bliznyak light bomber is powered by two axial flow turbojet engines and is estimated by Navy to be capable of Mach 1 plus performance in a shallow dive. In this sense, close to the Soviet Il-28 Beagle, it is comparable to the U. S. Douglas A3D Skywarrior. Wing is shoulder mounted with two wing fences on each side. Outstagger leading gear pods are at tips. Vertical tail is sharply raked and squared off on top, two vertical fins or struts are visible, these Navy models show. Span is 37 ft., length 70 ft.



...possibly you too can benefit from our defense production experience



MECHANICAL DIVISION



Electra Engines Perform Well in Flight

experienced a simple power failure somewhat unexpectedly in fuel was that off to No 1 engine, flew with propeller in maximum drag position, then with propeller feathered, cut-fueled propeller and regarded as gone, returned to Beirut and flew conventional landing pattern under reduced visibility conditions, landed, taxied in and parked. Flight time up recorded 14 hrs.

A predominant characteristic of this turboprop test bed is its simplicity. Application of takeoff power gave the aircraft a quick buildup to takeoff speed and, after liftoff, the usual fuel change accompanying power reduction in piston engine plants was considerably less as turbine power was reduced.

Rate of climb to chosen altitude was good. Although test had comparisons pooled across engine inductions of Electric performance and characteristics, inductions were given of good margin in performance available using turbo-prop power in Constellation, a case limitation in which several potential customers are reportedly interested. Climb rates were somewhat above standard, while cruise speeds at approximately equivalent horsepower output per unit age gave better than 20 mph higher indicated or mach numbers.

Light-power changes produce re-
sults quickly but smoothly. Large
power reductions are not followed by
the sudden slowing effect of piston
engines. The wide chord propeller blade
results in a smoother slowing of a rate
which still is fairly swift.

Reapplication of source populations is

high acceleration along the plane;
digital pads without such pads effects
as torque mass acceleration torque, and
acceleration propeller rotation; in
case of high actions.

At sustained engine-out, a strong tendency was felt to power round. Sustained flight with the propeller at maximum drag position was not difficult. No attempt was made to turn out No. 1, but rather to fly with them for a better assessment of their value in that the worst possible drag situation, where more than 400 hp is being applied to drag factors at engine revolutions. Trenchard was accomplished after feathering, and in the feathered condition, flight characteristics were standard, with no noticeable extra effects due to the dead engine and its low profile drag.

Disturbances produced on a normal characteristic except that sand was in period of piston strokes after an initial 2 to 3 sec. accuracy, characteristic started to return from engine-out to engine flight conditions. However, during undocking, a small pull was felt as propeller again went through the maximum drag condition as its windmilling pulled the turbine back toward operating rpm and blade angle of attack passed from feather to flight regimes, both occurring prior to initiation of main engine.

Conventional technique was used in descent to pattern altitude; engines were set at flight idle power. As power is applied to compensate for lowered gear and approach lap, together with pattern



Lackland C-130 Hercules, under Marine-Navy test at Parris River, Md., which Mr. Donnell FINEIN and Commander FINE of 25,000 ft.

EXPERIENCE is the best feature

Management uses any experience put Rohe on top in major aircraft components. For, at Rohe, there's more than just experience in design, engineering and production (there's the vast know-how to conceive and construct ingenious machines that build better products at lower cost.

Long experience has led to Rohe's world leadership in the design and production of ready-to-install power packages for airplanes.

Furthermore, today Rohe leads in design and development in advanced aircraft structures programs such as years ahead high strength weldments (shown below).

In aircraft components, experience is the best feature. It's a vital part of the 58,000 different parts built by Rohe.



Rohe Plant and Headquarters: Chula Vista, Calif.
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Enter options for airplanes and helicopters.



Taped Seams Cut Drag on F-102A

Paralleling the F-102A is covered by 21 in. strips of silver polyester tape which cover seams in leading edges of plane's wings. Tape is two inch thick, helps eliminate drag which occurs at supersonic speeds. Aeronautics on Boeing were also taped in order to reduce turbulence at high speeds. Tape, which can be removed easily from skins for servicing, is being applied by 141st Fighter Group, AEC, Dulles, Miss.

Eight and final approach, all engines of F-102A's turbojet power system became very apparent.

Use of the power lever, plus fuel response without surge under final approach conditions, clear in the approach to Barlow, in Shenandoah for runway alignment after a directional overshoot, plus power application with full flaps down to correct for an inverted pitch-over, were accomplished. The power lever provided manual control of throttle, propeller controls, constant, and, in addition, the response was immediate, adequate and smooth when power direction was applied, with less than usual control differences required to steady the aircraft compared with the necessary when equivalent power is applied to other engines on final approach. Reversing power after correction was again smooth enough so that throttle in flight controls for aerial landing was easier.

Test Bed Data

The test bed RTV-2 is basically a 1949 model Continental which was modified to take Pratt & Whitney T-14 turbojet, for a Navy evaluation program. Lockheed put T-14s into two planes such as USAF and Navy, in making data gathered in its current test program available to both services. The loaded aircraft was not modified for the RTV-2 installation, with a somewhat aerodynamic and thrust line effect resulting. Nacelles for T-14 are wider, higher than those of RTV-2, so about 500 installations, differences in section were forced, leaving a cross-section area between nacelles, side behind the engines themselves and just ahead of wing. Also, three line of T-14s was on the map, but RTV

level settings of less than 65 deg. power is controlled by fuel scheduling to cause the desired rpm, with propeller control for altitude, temperature and other factors compared automatically and compensated for.

When the 65 deg. position, power level position calls for a constant turbine inlet temperature, with propeller blade angle changing to absorb extra power while rotating to its programmed rpm and that of the engine at a constant level. And while a single fuel scheduling is accomplished in the power lever above the 65 deg. setting, the temperature device takes up the slack in the system, acting as a fine fuel requirement trimming.

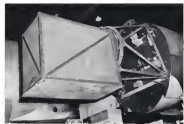
Power Settings

Two time power lever settings are about and below an angle of 65 deg., with full open position considered as 60 deg.

A temperature device valve is an essential part of the system. At

level settings of less than 65 deg. power is controlled by fuel scheduling to cause the desired rpm, with propeller control for altitude, temperature and other factors compared automatically and compensated for.

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Engine Mount Strength Test

Agas engine mount is tested by Chrysler, Ltd., for strength by attaching a 7,000-lb. cross block to the mount. Mount is attached in barrel by four bolts.



PORTABLE RADAR STATIONS MEASURE AND DOUBLE CHECK 50 MILE READINGS IN SECONDS

For the first time, surveyors are freed from short-sighted optical equipment. Unlike old-fashioned surveying tools, the "radar ruler" pierces through fog, darkness or dense foliage, electronically peering off distances of 1 to 50 miles, precise to within a few meters!

This new general-purpose ranging instrument was developed by Motorola's Military Electronics Laboratory for the Signal Corps Engineering Laboratories, Fort Monmouth, N. J. The entire operation can be handled easily and quickly by untrained personnel.

The self-calibrating system uses two identical portable radar stations which bounce a signal back and forth thousands of times each second. High-speed computers automatically provide the data necessary to measure off the distance.

Here is just one more example of the equipment now being developed by Motorola for many varied military applications.



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device to maintain the exact specified temperature called for by power level setting.

Throat Air Flow Testing

Speedy and too, conductible advantage of engineers at throat for two points while propeller blade angle about half flat pitch, sometimes using over into the belt or reverse rings to maintain the ground side up at specified 18,000.

While has included an Electro power station a sensitive turbine salt temperature gauge capable of fine readings. Replacing the downstream adjustment, the turbine, which temperature reading will give plots in total effect, on power station, wave temperature at the point accurately reflects population efficiency in terms only read by a bare plate. In addition, unexpected temperature fluctuations in this area would warn of possible danger situations.

Also for the benefit of pilots, a direct temperature reading gauge will be incorporated on the Electro drive line a BMEF or temperature, with pulsed located between the propeller reduction gear housing and the front of the turbine shaft, for an accurate indication of horsepower being delivered to the turbine engine.

Air Short Procedures

To start for the 501113 no no problem for two-point operation. After computer should handle for fluids at flow all is returned to manual position, with fuel and ignition switches in "off" position, induction battery is activated until engine starts running. Up to maximum speed, after which fuel is turned on and engine rechecked.

Observations during the flight show of that fuel flow it varies power settings at the chosen 5,000 ft. altitude range between 1,300 and 1,180 lb. at cruise conditions with 1.9C ambient air temperature. Range of turbine inlet temperatures was from 980C at light 50% conditions to 970C at maximum thrust power with weights of flight engines in the 580C to 590C bracket. Quick application of maximum continuous power from light idle position produced a marked continuous drop the flight path, to the extent that a person walking forward in the plane's side took two extra steps in each step, but did not lose balance.

Noise Ineffective

Noise barrier during wide power changes revealed noise about decreasing turbid at sound at higher pressure rather than any change in pitch at level of noise.

Lack of vibration was demonstrated with a two-foot pipe balanced on a table in engine flight and though

Actual Size Model 4110 Accelerometer—same in operation

0.1% Linear Accelerometer

COMPLETELY TRANSISTORIZED*

ACCURACY: 0.1% of Full Scale
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REPEATABILITY: Better than 0.002% of Full Scale
WITNESS: 2.5 Gases
OUTPUT: 0 to 5 vdc supply voltage of 0.1 vdc
POWER REQUIREMENTS: 120 milliwatts total input



The Donner Model 4110 precision linear trans accelerometer is a self-contained subcomponent of the standard Donner vacuum tube module which has been doing planned performance for the past 2 years. Requiring only 15 watts of unregulated dc power at maximum levels, the Model 4110 delivers 0.1% linearity at output of 0.1% accuracy. Zero stability and linearity are enhanced by the self-contained high gain zero system. 50,000 threshold noise equivalent level —0.02°C to +300°C.

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| APPROXIMATE PRICE | MODEL 4103 | MODEL 4110 | MODEL 4111 | MODEL 4112 |
|-----------------------|--------------------|--------------------|--------------------|--------------------|
| ACCELERATION | 0.1% Full Scale | 0.1% Full Scale | 0.1% Full Scale | 0.1% Full Scale |
| REPEATABILITY | Better than 0.002% | Better than 0.002% | Better than 0.002% | Better than 0.002% |
| LINEARITY | ±0.001% | ±0.001% | ±0.001% | ±0.001% |
| RANGE | 0 to 10 g | 0 to 10 g | 0 to 10 g | 0 to 10 g |
| OUTPUT SIGNAL | 0.1 vdc | 0.1 vdc | 0.1 vdc | 0.1 vdc |
| OPERATING TEMPERATURE | -55°C to +125°C | -55°C to +125°C | -55°C to +125°C | -55°C to +125°C |
| CONSUMPTION POWER | 15 watts | 15 watts | 15 watts | 15 watts |
| WEIGHT | 100 g | 100 g | 100 g | 100 g |
| SIZE | 1.5" x 1.5" x 1.5" | 1.5" x 1.5" x 1.5" | 1.5" x 1.5" x 1.5" | 1.5" x 1.5" x 1.5" |
| PRICE (each) | \$250.00 | \$300.00 | \$400.00 | \$450.00 |

Write for Data Plus 215 describing Donner's full line of accelerometers.

Model 4110, 28G

*Total RFI 100 dbm (100 dbm) and no external military equipment. Fully automatic operation with 100 dbm. No external signal for maximum operation.

*Output constant linearly 0.1%.

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PIONEER-CENTRAL INTRODUCES NEW FLIGHT INSTRUMENTS FOR JET AGE REQUIREMENTS



VERTICAL VELOCITY INDICATOR
MODEL 1054

Designed to meet the existing lighting and performance requirements of jet age commercial, military and business aircraft, Pioneer-Central's new Vertical Velocity Indicator features integral lighting and rapid response indicators.

Rapid response enables the pilot to quickly establish and maintain uniformly precise rates of ascent and descent during climbout and landing—a necessity in today's high-density traffic areas and at the high speeds of modern transport aircraft.

Available in four versions—integral lighting—reads white by day and red by night. Red—the color science has proved best suited for "dark-adapted" eyes—provides sharper readability.

Model 1054 complies fully with lighting specification MIL-L-25467A and is CAA approved to TSO-C14. Units are available in either standard 3" bezel or champagne style enclosures.

Turn-and-Slip Indicator, Model 3022, is another new member of Pioneer-Central's family of fine instruments. In use, provides integral lighting for better readability, reading white by day and red by night. Like its companion, at left, it complies fully

TURN-AND-SLIP INDICATOR
MODEL 3022

with lighting specification MIL-L-25467A and is CAA approved to TSO-C14.

Equally important are two additional design features—precision of a power failure indicator and reduced weight. Should power fail at any time, the flag shown at "full" position, upper right, instantly informs the pilot the instrument is inoperative. Reduced weight and simplified construction are achieved by the use of a gyro motor design operating from a single-phase 400-cycle AC power source. A similar unit is available with reduced gimbals for installation in fixed panels.

Turn-and-Slip Indicators of various types are available to operate from single- or three-phase AC, DC, or an aileron source. Computation instruments are in process of design and production—Airport Direction—Fuel Character System—Braking Order Equipment.

For complete specifications write Pioneer-Central Division, Bendix Aviation Corporation, Department Item West Coast Office—171 E. Pennsylvania, Burbank, Calif. Export Sales & Service—Bendix International Division, 295 East 43rd St., New York 17, N. Y.

Pioneer-Central Division

CHATTERT, IOWA



Pioneering In Our Business

Product Divisions of Aircraft Instruments, Braking Order Systems, Fuel Character Systems, and Electronic Controls

AVIONICS

GE Seeks to Predict 1972's Weapons

By Philip J. Klein

Santa Barbara, Calif.—General Electric has assembled here a staff of more than 50 top physical and social scientists and engineers to answer a question of vital importance both to the nation and to the company: How can the current concepts on the technological limits and the capabilities of use of the country's largest defense electronics manufacturers best be applied to produce the weapon systems needed for 15 years hence?

General Electric's Technical Military Planning Operation, called Tempo for short, is unique in many respects in the defense industry. Many manufacturers have groups of long-time planners. But none is as large or as comprehensive in scope of activities.

Trend Study

The Technical Military Planning group seeks to evaluate future trends in response from a political, economic and psychological as well as from a technical standpoint. For example, the nation's oldest effort in ballistics analysis could require a computer unit consisting of all its efforts in the next field. A study by General Electric's planners points up certain political developments of the ICBM compared to hypersonic missile boundaries. For example, the nearest bomber can be launched prior to hostilities but can be verified short of the target in event of a sudden change in the international scene. This suggests that both nuclear and jet-powered weapons are needed for strategic bombing.

Other studies range from the jet while effect of future solid propellant rockets on international relations to the cost of operating an intercontinental ballistic missile base, and from a study of the feasibility of an electromagnetic gyroscope to an estimate of the likelihood of future "breakdown" conflicts and their possible locations.

In the diverse and scope of activities, Technical Military Planning Operation, both basic research and the Rand Corp. Dr. Richard G. Reinhold, who heads the GE planning group, rose from Rand where he was chief of its electronics department. About one-fourth of the GE planning group performed staff work at Rand at one time or another.

But there is a significant difference. Rand is a nonprofit organization and has no product engineering emphasis.



TOP COMMAND of General Electric's Technical Military Planning Operation (Tempo) includes (left to right) T. A. Kinn, Harry G. Faxon, Fritz J. Schenk, Dr. Richard G. Reinhold, Tempo manager; Russell L. Knight, and Roy L. Stewart.

ing operations. Technical Military Planning Operation is part of GE's Defense Electronics division, whose product range from airborne electronic countermeasures to large ground radar and ballistic missile fire control. Annual division sales total about \$100 million.

One of Technical Military Planning Operation's major roles is to assist in three other departments: Basic Military and Light Military Electronics Equipment Department, and Missile and Guidance Systems Department. Tempo itself has no laboratory facilities. Its scientists work with paper, pencil, computers, and their minds.

When laboratory investigations are required, they are turned out to other departments or to GE's laboratories in Research Laboratories.

Outside Customers

About 85% of the current effort is devoted to weapons projects, the balance to outside customers—ranging from the military services and to civil atomic power contractors. The GE group hopes to increase outside sponsored projects to about half its total effort during the coming year, according to Dr. Reinhold.

One requirement project, now under consideration, is with a Navy aircraft supplier. It calls for a Technical Military Planning study to recommend the kind of atomic detector and guid-

ance equipment which will be required for antinuclear warfare in the 1950's. For such a study, the GE planners will use the knowledge of its inter departmental as well as its own.

Tempo recently identified a proposal to the Atomic Administration based on an report design criteria which would include such things as: man-made, lighting and surface traffic control aids.

Outside Sponsor

The reason for seeking outside sponsorship is based on economic necessity. A great deal of talent is required to explore the future factors which influence the nature of international conflict and weapons. Physical scientists with backgrounds in such fields as astronomy, electronics, geophysics, economics, mathematics and logistics cannot be supplemented in usual scientific work with backgrounds in political science, economics, geopolitics and psychology.

The maximum size staff is "critical mass," as Dr. Reinhold refers to it—needed for an operation like the technical planning group is too large even for a giant like General Electric to support on its own. Reinhold admits.

With the present professional staff of slightly over 50, and a comparable number of supporting personnel, which Dr. Reinhold believes is only slightly over

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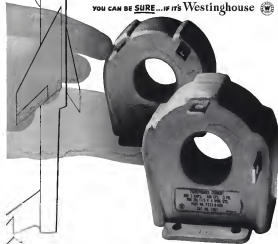
Molded from a new high temperature insulating resin, this new transformer is smaller, lighter — actually weighs less than three times as much, has a height and width of only 3 1/4 inches.

The new unit has a 250/3-ampere current ratio and operates on 115-volt, three-phase, 400-cycle systems. It fulfills the requirements of specification MIL-T-72118 for Type D-3 current transformers.

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a unit

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the "crabbed man," the planner's annual operating budget is about \$1 and his.

Funds come from increments in sales operating departments and outside contracts.

By expanding outside sponsorship, Dr. Barnard hopes to be able to increase the professional staff to about 100 next summer and support further modest growth in subsequent years.

New Group Started

Two years ago, GE formed a group to study its defense electronics business and to recommend organizational changes which would enhance company's position. One of the recommendations was the creation of Technical Military Planning Operations. Another was to split off GE's defense electronics efforts from company's consumer and industrial electronics activities. Now Defense Electronics division, under Dr. George L. Heller (who headed this group), was formed in May 1956. The planning group was created shortly thereafter.

Two of the significant defense electronics trends pointed up by the study which led to Foreign's formation were:

- Warhead pace of technology was forcing military to turn to industry for more guidance in determining what could be accomplished in future weapons for the military.

- Size and complexity of military electronic systems was growing rapidly. General Electric found that out of its average defense electronics contract had increased by 100-500% between 1946 and 1956.

Need for Planning

This pointed up the need for a broad, long range planning group, both to guide the company and to assist the military.

A single bad decision on whether to bid or turn down a large new weapons system program could have a serious impact on GE's future business, according to Peter J. Schmitt, marketing manager and a member of the study group.

Each of GE's defense electronics departments has long had its own product planning group, and still retains this function. However, under general rules of GE's declassification, each department operates almost like a separate company.

This tends to oversimplify the area of such department's planning as an era when growing weapon system complexity often cuts across two or more departmental lines of authority.

Sometimes this has resulted in overlapping areas of interest where two GE departments competed against one another. It also has created technological "no man's land" where the company



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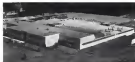
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Here highly trained personnel with widely diversified skills meet the thousands of complex problems that arise in the manufacture of precision aircraft products.



Within this air-conditioned plant's 160,000 square feet... a Model Shop with the most advanced equipment... a wide range of modern, highly accurate Environmental Testing facilities... a special "Shoe Order Shop" to smoothly absorb the low activity of an aircraft contract in its early production stage.

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should have been active but was not because of departmental barriers.

Crossing Barriers

One of Temp's tasks is to conceive and analyze complex weapon systems which cut across assigned areas of responsibility at once three inter-organizational departments.

Buited to this is the group's search for technological yards where GE should be active to give it the capability for living on future weapon system developments.

Still another objective, according to Dr. Raymond, is "to improve GE's living average" by assisting operating departments in selecting those development programs which appear to hold the best promise of going into production.

For example, the phonics might counsel an operating department against bidding on a new weapon development because analysis indicates little likelihood of ultimate production.

However, the final decision rests with the operating department.

Control Selection

The need for careful program selection is becoming increasingly important as a result of recent Defense Department statements that faster development programs will be allowed to continue into production, and as a result of the growing engineering involvement that goes into new weapon developments. Until government-sponsored development is made a profitable and an end, a manufacturing company like GE must view its development effort largely as a

means to one end—production.

Organizationally, Technical Military Planning Operation is divided into five groups.

• **Environment**, headed by Reg. Gen. Harry D. Brown (Army, Ret.), seeks to define the environment in which future technological conflicts may occur, including geographic, economic and psychological considerations. Physical and social scientists within the group seek to keep abreast of all new technological developments across a broad spectrum of sciences in order to predict how they can or might affect future weapon systems.

• **Synthesis**, under T. A. Ryan, performs a role which might be compared with geologists' design in an earth's crusting, or with systems engineering in an aviation company. The synthesis group, made up largely of physical scientists and engineers, interprets military operational needs in the light of use technological advances to derive future weapon systems. Preliminary designs are carried to the point where development department design can begin if it is decided to develop the weapon system.

• **Evaluation**, under Roy L. Stewart, Jr., critically evaluates weapon systems, usually by means of an operational analysis. Analyses are made with respect to such factors as the stated operational need, the computed effectiveness of the system and its overall cost. Evaluation group is a member of "joint directed staff" institutions, economists and operations analysis.

• **Marketing**, under Peter J. Schmidt, performs marketing liaison between

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| | |
|-------------|--------------------|
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| Voltage | 115 V \pm 10% |
| Maximum | 100 mA |
| Input | 25 to 250 VDC |
| Temperature | -55°F to +100°F |
| Vibration | 150 to 1000 cps |
| Size | 30 x 10 x 10 |
| Weight | 3 lb. |

Vaco transistor inverters are designed to operate systems in guidance systems. They are frequency regulated by a Vaco internal tuning fork, voltage regulated by a zener diode reference, and produce a sine wave output through Class B amplifiers.

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Electronic Slide Rule

Small general purpose digital computer designed for engineering laboratory students operating machinery and chains of automatic production of direct print or hard copy output of operations. Developed by International Business Machines Corp., cost \$300,000 with the \$55,000, cost for \$1,000 per month. Typed computer speed is 0.37 sec. for over one million operations, 0.15 sec. for address or subtraction. Machine has magnetic drum memory, memory operating instructions on punched tape.



FOR STORM AVOIDANCE: This is a typical storm as it appears on pilot's indicator. The dark hole indicates areas of high turbulence. The nearest, pilot can select a safe, comfortable flight path toough to avoid storm area.

FIRST "150-MILE" WEATHER RADAR THAT FITS ALL THREE!

New Bendix equipment meets all requirements—from twin engine business aircraft to latest jets and turbo-props*

Jet age requirements for more compact, lighter weight equipment of airline caliber have inspired some impressive improvements in aircraft accessories design. And lie out front in the vanguard of these improvements you'll find Bendix' new 150-mile-range weather radar system... the RDR-1D. Substantial weight and size reductions, without impairment of quality or performance, now enable Bendix to offer this airline type weather detection radar equipment to a much wider variety of business and commercial aircraft.

Performance equals that of present commercial airline type weather radar systems requiring twice the amount of electronic rack space. The total system weight is now approximately 85 pounds. What's more, the new components are interchangeable with Bendix' famed, time-tested veteran of the global airways, the RDR-1B X-Band System. The built-in flexibility and versatility of newly-designed components make it possible to "customize" Bendix Weather Radar

to fit practically any type of aircraft on the market.

For aircraft lacking sufficient space for the larger 22- and 36-inch "dnh" type radar antennas, new 15- and 18-inch sector scanning antennas especially designed for limited configurations will be available.

In addition to its primary function, this new RDR-1D weather radar matches its famous counterpart for ground mapping and terrain avoidance.

For complete information and performance data, write to Bendix Radio Division, Aviation Electronic Products, Baltimore 4, Maryland, Or West Coast—10500 Magnolia Blvd., N. Hollywood, Calif. Export—Bendix International Division, 265 E. 42nd St., New York 17, N.Y. Canada—Computing Devices of Canada Limited, P.O. Box 508, Ottawa 4, Ontario

*See page 100



FOR TERRAIN AVOIDANCE: A warning for detecting high terrain in flight path is an additional feature of Bendix Weather Radar. This is particularly valuable under instrument conditions, due to instrument failure, or when all other indicators of high terrain mountain ridges in flight path, give pilot ample time to take avoidance action.



FOR GROUND MAPPING: By using antenna downward, pilot can see substantial terrain features, such as other aircraft, clouds, lakes, etc. Area covered depends on altitude and degree of antenna tilt. Pilot can adjust his picture accurately at night or under conditions of limited visibility by reference to known landmarks.



RDR-1D Transmitter Receiver
ENH-1B Synthesizer Power Supply

Now RDR-1D Transmitter Receiver weighs only 35 pounds. Synthesizer Power Supply only 21 pounds. Total rack space for complete system is only 3.475



Bendix Radio Division

BALTIMORE 4, MARYLAND





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TOUGHER / Packard Silicone Cables have greater resistance to abrasion!

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are strong and flexible enough to withstand rough installation handling. Packard Silicone Cables have a tough, dense, compact sheath, and add extra density throughout insulating layers helps overcome almost all problems of compression set. There are no signs of the soft spots so typical of ordinary silicone cables. Besides, the insulation is non-flammable, and has great uniformity in dielectric strength.

No other silicone cable meets the performance standards of high heat,

high-tension Packard Silicone Cables. They are made in 5- and 7-strand configurations. Write for information and samples. Packard maintains offices in Detroit, Chicago and Oakland, California, for your convenience.

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"Low Price" division of General Motors

contrast to build message-carrying equipment, experts able to design and manufacture airborne communication and navigation equipment.

• **Collins Radio Co.**, Cedar Rapids, Iowa, has reorganized and enlarged its motion picture department. New equipment authorized 21 factory outlets to sell direct, 15 of these also serving as distributors for 77 additional dealers. Total dealer/distributor organization now numbers 113 companies compared to 25 previously.

744999 FILTER CENTER SALES

• **Dugler Nceptor vs. BME-T**—Air Transport Association is studying possibility of domestic airline use of Dugler automation, including dual-sensing computer, instead of distance measuring equipment portion of BME-T. ATA's studies will consider technical, operational and economic factors.

• **AN/GSN-1—AN/FPN-14** Waddell: New production prototype version of GSN-1 submarine landing system, being designed by Bell Aircraft, is intended to mate with new FPN-14 long-range terminal area anti-aircraft radar being developed by Bendix Radio. GSN-1 is to provide fully automatic control of aircraft from 200 mi. out to touchdown. Both programs are sponsored by Rome Air Development Center.

• **Testimony Approaches Increasing**—Number of instrument approaches made between July 1, 1956, and June 30, 1957, peaked 47% in previous year, while number of fix postings made by an enroute traffic control center soared nearly 25 million, a 22% increase over previous year. James T. Pyle, Civil Aeronautics Administrator, told recent meeting of Radio Technical Commission for Aeronautics. Pyle said CAA spent \$77 million in last fiscal year for traffic control facilities and equipment, expects to spend more than \$120 million this year.

• **Traffic Control Symposium**—The Aeronautics Modernization Board, Mission and Methods will be the subject of a three-day traffic control symposium, Dec. 16-18, to be held in Philadelphia. Speakers will include Elwood B. Quisenberry, ANB chairman, members of ANB staff, speakers for Defense and Commerce Departments, and civil aviation users. Symposium is sponsored by Franklin Institute. For details, write Air Traffic Symposium, Franklin Institute Laboratories, 2206 E. Parkway, Philadelphia 3, Pa.

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Flexflyte is an exceptionally lightweight ducting that is highly resistant to abrasion, vibration and flame and maintains its temperature from minus 120°F to plus 650°F. It will handle internal working pressures up to 70 psi and external working pressures up to 15 psi depending on type. Designed for use with venting, deicing and de-icing systems, Flexflyte will take tight turns at any point up to 180° without buckling. No elbows or special fittings are required for installation.

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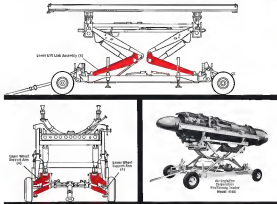
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Kaiser Aluminum forgings are shown in red in the drawings above.

ALUMINUM FORGINGS SAVE UP TO 50% IN COSTS — 50% IN WEIGHT

As determined by Air Logistics Corporation cost analysis, the forged aluminum wheel support arms shown above returned a 50% cost saving, as compared to steel weldments. The lower lift arms returned a 10% cost saving.

These same aluminum forgings also made possible the following savings in weight as compared to steel: Wheel support arms—58% weight saving, lower lift arms—40% weight saving. Yet the trailer shown is strong enough to handle loads up to 8000 pounds.

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provided superior springing action and added pleasing appearance to the trailer.

Next time you're faced with a design problem involving costly and complex parts machining and assembly, consider the inherent advantages of single aluminum forgings.

For complete information contact the Kaiser Aluminum Sales Office listed in your telephone directory. Kaiser Aluminum & Chemical Sales, Inc., General Sales Office, Palmolive Building, Chicago 11, Illinois; Executive Office, Kaiser Building, Oakland 12, California.

THE BRIGHT STAR OF METALS



TYPICAL launch trajectory for Meteor Junior is shown, including separation points at first second and third stages.

Goodyear Proposes Smaller Space Station

Raytheon-Snell suborbital earth satellites which could be launched by ICBM-type rockets were proposed last week by the Goodyear Astronaut Corp.

The two to four place vehicles are intended to be the most economical means of carrying men into the gap between the X-15 research aircraft and satellite performance.

The Goodyear study is named Meteor Junior and is part of a program to take full advantage of all weight sent into space by using the transport vehicles in structural parts of a space station.

Previous Criticism

Meteor Junior was presented to the Eighth Aeronautics Congress of the Inter national Astronautical Federation apparently in reply to technical criticism of a Goodyear paper given last year before the Society of Astronauts. That year the presentation of a Meteor proposal costumed 25,000,000 lb. rockets and space stations for thousands of people and drew criticism as being an overestimation of existing technology.

Both of these papers were written by David C. Rowell, Richard E. Knight and Stewart Black.

Meteor Junior project is outlined this year proposal, launching three stage rockets weighing from 250,000 to 1,000,000 lb. and building space stations for a few score people at a time. Meteor Junior does not have the load-carrying efficiency of the larger space multibodies

relates, but in the eyes of its designers it requires no more technical information than will be available in 1962.

Date Sources

This new knowledge which is to make space flight possible for humans would be provided by such active projects as the X-15, Atlas and Vanguard. Goodyear has the key information they are to furnish consumers.

• Aerodynamic drag, heating and re-

- entry effects at very high speeds
- Atmospheric ionization, dissociation and other phenomena which affect communications and vehicle behavior at very high altitudes
- Stability and control of vehicles beyond the usable atmosphere
- Development of large rocket motors to operational status

If these projects are allowed to con-



BOOSTER 1 separates from the smaller but includes constructed second stage. All and all body has supports for securing in case of first stage separation catchup suction point and push. When separation from third stage occurs, vehicle is traveling 15,000 mph.

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the research and production facilities to make all this a protective reality today. Its Advanced Electronics Center at Elmsford, New York, has an INFRARED Projects Group staffed by recognized authorities on IR development. INFRARED by LMEE... with its broad applications to Airborne Weapons Control Systems... is another LMEE contribution to new uses of Defense Electronics. For information on IR... write Section F.

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FRENCH ROAD, UTICA, NEW YORK

METOR JUNIOR ferry vehicle approaches moon (top right), prepares to leave moon (below).

time to completion and spare flight power feasible, the main advantage of pressing the Meteor Junior approach would be economy. Its important features are compact, as different from other older ideas, but the use of its vehicles are smaller than most of those that have been suggested in space flight experiments.

Development of Meteor Junior's could begin with the third stage. Crew training with simulators would begin almost as soon as the design of the vehicle. The crew would perform all preliminary flight tests of the third stage as well as ride it into an orbit and later bring it back to earth.

Modified ICBMs

The first and second stages of Meteor Junior would naturally be modified ICBM's missiles. These would be capable of placing a light third stage carrying two men into an orbit.

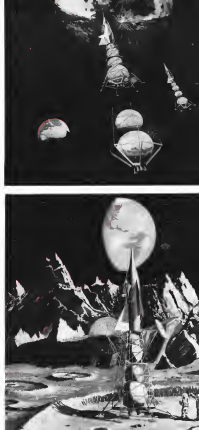
Later the use of the first two stages would be increased and they would have wings and a crew added. They would then be able to launch a much heavier third stage carrying up to four men and a ton of cargo. Once these stages had burned out the crew would glide them back to earth and they could be reused. Jet engines in pods would be attached to each stage after the return to earth and then could be fired from the landing area back to the take-off site. This would cut the number of booster units to maintain an given flight schedule.

This type of recoverable booster arrangement plus the heavier payload of the third stage is considered necessary for the economical reconstruction of a small, manned space station. Such construction in space would require many "light" flights into the orbit. As each booster would cost several millions dollars the price would soon become prohibitive if this were only used once. Fuel cost would be \$100,000 for the reusable booster stages of each flight.

Ground to Cover

The efficiency and use of the powerplants specified for this third stage, a liquid-fueled Meteor Junior, gives some idea of the power that has to be carried in industry if the problem is how that manned space flight will be possible in 1962. The Goddard study calls for many liquid thrusters in an engine and obtaining an actual specific impulse of no less than 275 sec. This is well beyond today's capabilities.

The total thrust of the 27 engines needed to propel Meteor Junior into a 500 mi orbit is 1,504,000 lb. The co-





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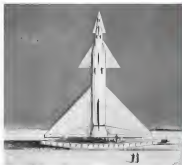
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BOEING 707



MINUTEMAN could be assembled incrementally and then moved by sliding on launchers.



PLANFORM of three stages of Minuteman vehicle is shown in drawing.

parts are distributed as follows:

• **1st Stage**—17 engines of 150,000 lb. thrust each

• **2nd Stage**—6 engines of 46,000 lb. thrust each

• **3rd Stage**—4 engines of 5,300 lb. thrust each

Some of the nation would be guaranteed so they can be used to provide control of the vehicle.

In the light of current experience the reconnaissance and engine control problems presented by this array of

powerplants would seem formidable even when taken from above.

After the third stage of Minuteman are placed in orbit they would be modified to become space vehicles for tracking to the moon, rocket vehicles and vehicles for carrying personnel and equipment to earth. They would also serve for landing blocks in space station construction.

Two types of moon traps are required by the Goddard group, one an explosion flight around the moon and



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Weapon systems management activities at Lockheed's Palo Alto and Sunnyvale operations have demanded accomplishment of a high order of flight dynamics work such as: Analysis of acoustic dynamic motion and establishment of stability and control system criteria for injectors with 3 or more degrees of freedom; development of techniques for the analysis and interpretation of flight dynamics test data at hypersonic speeds; study of spatial dynamics problems arising during preliminary design and development of missile systems. Inquiries are invited. Please address the Research and Development Staff, Sunnyvale 17, California.

Left to right: S. S. Edwards, flight dynamics; E. W. Marsh, aerodynamics; M. Tucker, aerodynamic dynamics Department manager; and R. L. Nelson, project aerodynamics, dynamic system dynamics

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Houdaille Flutter Dampers are completely self-contained, precision-built hydraulic mechanisms—specified by leading aircraft manufacturers for their dependability and performance. Normally supplied with MIL-D-3800 fluid, available at all operational bases, they may be furnished with the new high-temperature fluids when specified. A thermostatic valve insures constant damping characteristics over a temperature range of -65° to 300°F and above.



CONTINUOUS TESTING and rigid quality controls are standard procedure at Houdaille. Production dampers must undergo extensive tests for strength and life on equipment such as this, to make certain each unit meets all phases of the customer's specifications.

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• Several modified engineering applications are available to complete product review before an order

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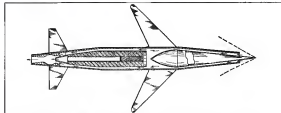


SOLID FUEL RAMJET



Ramjet Uses Solid Fuel

Solid fuel ramjet which has been under development by Continental Aviation & Engineering Corp., Detroit, Mich. (above), is designed to combine the ease of an air-breathing powerplant with the mobility of a solid propellant rocket. This form of a new rocket was the first that a pure solid rocket would use for the main stage because it is a solid in one piece, the others are in pieces. Because some rockets are incorporated in the solid fuel being of the combustion chamber, the ramjet is said to be capable of operating at higher altitudes than conventional rockets. Below, U.S. patent 2,799,887 shows another solid propellant concept developed by Hercules, Edward F. Chaffin, Boulder, N. Y.



back to earth and the other a landing on the moon and return. The first type would require only one booster stage in addition to the Meteor (upper third stage already in the orbit). The second type of top calling for a landing on the moon with the three additional boosters, making a total of four stages. The moon landing craft would weigh 541,500 lb. (including fuel). A fleet of these would be used for the trip as a safety measure. The crew from any disabled craft could be taken aboard the returning ship.

Continental estimates that the initial cost of the 1,000,000 solid propellant rocket fleet plus the cost of ferrying it into the space station orbit so

it could be assembled would be slightly over \$100 million. This of course does not include any of the development cost of the Meteor launch equipment. The cost of Vanguard Project to date, for instance, is in the neighborhood of \$500 million.

A special note would be fitted to the third stage of Meteor launch so that it would function as a pusher-type rocket vehicle. Such data would be given over toward the space station when a freight or passenger rocket coming up from earth would not reach the precise velocity of the space station and would enter another orbit. This vehicle would enter the orbit of the standard rocket and bring it to the space platform.

3 Tower Facilities Companies in Merger

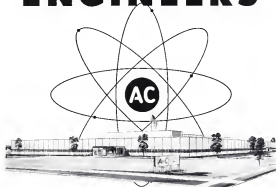
Dallas-Norwest Electronic Facilities, Inc. has been forced last to provide complete electrical tower services. Now firm is a consolidation of three tower contractors under the leadership of President William M. Thibault.

Tower Contracting Co., Taylor Maintenance Co. and Atlas Manufacturing Co. have joined forces in National Electronic Facilities to provide engineering, design, construction and maintenance of radio, microwave and solar towers and systems associated facilities.

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REDSTONE body, with worknet, pulleys, is lowered on cradle.



THRUST cut is moved up for working with thrust section.



THRUST section (above) consists of fuel tanks, propulsion system, tail.



Army Missile Unit Assembles Redstone



LAUNCHER (above) is spotted to ensure the missile, which is being hoisted by helical crane.



CABLES (left) which survey parachute pressure to enable are attached to multiple coupling on silver box of launcher above. Head of first lance above tail in shield and liquid oxygen flow into inside tank.



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BUSINESS FLYING



NEW BUSINESS PLANES, including Accon jet amphibian (back, foreground), showed Devoe others the industry's growing wings.

Explosive Business Flying Growth Seen

By Ervin J. Bellus

Devoe-Accon partnership in U.S. programs to modernize aviation facilities was official business from its White House official during National Business Aircraft Show & High Altitude Meeting & Forum here.

The major political breakthrough, together with a display of major technical developments that promise to have explosive effects on the U.S. aviation economy, forecast further increases in rate of growth of business flying, paving the way to a dominant position in the aviation industry in the next few years.

These developments, a cross section of what occurred at the biggest and most successful NBAA meeting yet, follow in detail.

• Invitation by E. R. Devoe, special assistant to President Eisenhower and

chairman of the influential Airways Modernization Board, to become Devoe-Accon's partner in ANBP's programs to modernize completely U.S. aviation facilities. This type of recognition from a high level in government has caught Accon's eye, for business flying for years, so far, had caused sustained feeling toward military and aviation for years.

Personnel Needed

Adding for the "touch support" of NBAA, and all other segments of general aviation, Devoe told business flyers that ANBP's philosophy is to acquire personnel on a full-time basis with background and experience in various types of flying in the U.S.

He stated that he is asking General Aviation Facilities Planning Group, of which NBAA is a member, to suggest the name of a man who would serve

as a spokesman from Accon to those for all new military and non-military aviation before the Board to advise it of business and private flying requirements, objectives, policies and capabilities.

Devoe said that he also wants one or two general aviation pilots willing to work with ANBP engineers and technicians to make sure that its proposed "don't develop technically obsolete pieces of equipment—but virtually worthless in the present pilot."

In addition, he wants about six general aviation people who will work for the government for less than \$10,000 a year as civil service employees.

ANBP will explore and get facts on urgent facilities needed for general aviation at terminals where high-performance aircraft turn in all kinds of weather, Devoe said.

• Placement of orders to help corporations for guidance in the production



Revolutionary design...and accuracy to $1''$ per hour

In a fully maneuverable twin gyro platform utilizing completely new gyro design principles, Sperry has achieved unprecedented accuracies in heading information and all-around flight. The first of these new Sperry systems will soon be delivered to the Air Force's Wright Air Development Center.

This Sperry system provides azimuth drift rate as low as $1/4''$ per hour, and at the vertical axis, $1/10''$ per hour. The use of twin directional gyros and new design techniques permits this extreme accuracy as it minimizes the disturbance torque inherent in conventional gyros. The low drift in the vertical axis maintains turning error-free freedom from correction control for longer periods of time.

Coupled with doppler radar navigation, the CIEP (Circular Error Probable)

is essentially reduced due to exceedingly low drift essential heading feature. The normal heading output permits either Great Circle or Rhumb Line flight paths.

The compactness of the twin gyro system makes it extremely reliable and easy to maintain. No warming period is required due to the balanced thermal construction and the absence of fluids.

The twin gyro platform has been designed to provide control information for complete and full maneuverability of high-performance aircraft without time to full stabilization in all attitudes. It is especially adaptable for Low Altitude Bombing Systems, fighter maneuvers and missile applications.

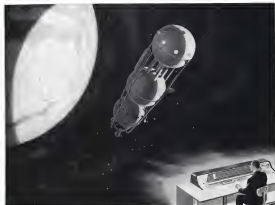
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- No Control Error
- Low Turning Error
- Multiple Axis Pitch-Heading Output
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J-1300—new iron-base turbine alloy

Easier to forge . . .
higher strength-to-weight ratio
than existing iron-base alloys

New General Electric vacuum-cast alloy J-1300 is specially designed for large forgings, such as turbine wheels, rings, shafts, and backshafts. It has the highest strength-to-weight ratio of any iron-base alloy in the 1300° F range.

Its rupture strength at 1300° F is comparable to that of other iron-base alloys at 1200° F. Its minimum guaranteed tensile strength at 1200° F is 138,800 psi.

In addition to its greater strength, J-1300 is more ductile—making it easy to forge. And its improved properties are easy to control and maintain during forging.

G-E alloy J-1300 is currently available in billets and bars. Substantial quantities have been made, and guaranteed mechanical specifications are available. For complete technical data, write for Bulletin VM-104 Metalurgical Products Department of General Electric Company, 12107 E. 8 Mile Avenue, Detroit 22, Michigan.

PROPERTIES OF J-1300

Tensile strength at 1200° F

Ultimate — 135,000 psi
2% yield — 112,000 psi
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Rupture strength at 1300° F

65,000 psi — life, 24 hours

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LOCKHEED SAYS that faster output equals military value, accelerating many companies are making progress on production line.

entering into any field that the FV-11 now gets into. Some operators made the comment that he would like to use the fighter's nosewheel steering control moved over to the cockpit's side of the cockpit.

On March 6, 650 Milesian Allison turbo-propeller powered executive transport (AW Oct 7, p. 12) will have "blowout doors" in its pressurized cabin so that in event of loss of pressure, passengers can evacuate the affected portion and retreat to another compartment section of the cabin, which can then be pressurized. The feature will operate automatically for rapid takeoff to conduct to an alternate field at lower, less critical altitude. On March President Robert Denny said.

Denny also reported on these features: • Allison engines, designed for IP-4 operation, can use turbo-engine fuel if necessary, in adjustment to engine that takes low thrust. IP-4 consumption will be approximately 132 gph using 2,015-imp. cruise power.

• Performance stretch is built into the

airplane and it will be able to take later development of Allison 501D-12 engine burning out 4,000 chp, considerably boosting current design 400 mph-plus cruise speed.

Boeing Development

Boeing recently detailed its development in the turbo-propeller executive transport field, covering a number of design studies the company has underway on a Boeing 18 replacement.

According to a market survey made by the company, there is a large demand for a 18-place 550-mph. aircraft, but Boeing studies show that price of this airplane would be over \$300,000, thus the \$120,000 that prospective customers would be willing to pay.

Company is investigating a whole family of jet and turbo-propeller projects aimed at covering the widest possible market. One particular aircraft design study is in the PD-112 study is a Lockheed 747 powered twin which would seat 100 passengers, cruise at 300 mph at 15,000 ft. and have a range of about

1,700 statute miles at this speed with 2,000 ft. of fuel. Zero fuel weight would be 11,388 lb., gross weight 16,150 lb. Basic empty weight would be 10,815 lb. with full cabin and cargo. Engines equipped, including fuel and water systems and 670 ft. of spread gear, already skinned windshields and radar.

Boeing feels that price would be in the neighborhood of \$650,000-\$750,000, fully equipped, such to operate, if a firm contract for about 200 aircraft was ordered.

Boeing is not waiting on these projects. There are strong indications that it will accept a number of Boeing Sabreer 545-760 two-seat four-place executive planes under an agreement with the French manufacturer.

Strengthening this observation was an invitation to business pilots at Denver by a Boeing representative to "see it" (545-760) now and fly it a million miles before a competitive type aircraft is available.

Indications are that these new entries



EXECUTIVE AIRSTAR HIGHER provides greater at cockpit layout (left), when being built. Side windows are 8 ft. 2 in.





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the quality of the job and, at the same time, lessen production time and cost.

In some instances, we have sliced production time in half on certain manufacturing operations of the J57. Of course, it takes skill, experience . . . and ingenuity.

Our jetmakers have a lot of each.

This ingenuity is an important factor enabling us to deliver quality jet engines, on schedule, at the lowest possible cost.



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in the business being market will be a tremendous spur to growth and expansion of the industry. Reasoning is that legitimate advertising, sales and promotion campaign efforts added by manufacturers like Lockheed, Fairchild, Cessna and De Mark to those by established firms such as Beech, Cessna, Piper and Aero Design will establish a higher rate of demand for all types of business aircraft.

Past experience has shown that many large companies purchasing lower anti-stress equipment also find a need for smaller, lighter and simpler equipment to provide economical sheltered aircraft.

Check of manufacturers present at Denver showed that despite their spots in some parts of the nation's economy, business aircraft demands are still climbing. Piper distributors, for example, are anxious to get delivery of the new low wing four place Comanche, a Beech spokesman told Aviation Week that the company could possibly sell 250 new Travel Air light twins this year, if they were available.

New Joint Efforts Sought by Pyle

Denver—Two major problems in aviation are frequently recognized as areas in that they can not only handle modern types but are also completely familiar with capabilities and limits, tests, and maintenance of existing equipment. General T. Pyle told National Business Aircraft Association members here.

In both these areas, the safety picture is spotty, Pyle stated, and must be jointly solved. "We must," he said, "come up with sound programs of pilot training, check-out and effective flight test procedures and top it off with a realistic program of periodic pilot proficiency."

Pyle also noted that pressure is building up among major aircraft manufacturers to reduce the amount of time required for FAA approval of these changes. An industry committee recently met with him on this subject, he said, and top-level Washington technicians are working with industry in expediting and clarifying procedures required for such approvals.

PRIVATE LINES

Beech D-55S modification, designated the Taper, features three blade Hartzel propellers, 180 hp wingtips, electrically actuated, air wing tank, fuel system that flows about 100 miles, 1000 lbs. empty weight, including radio and all structural equipment is 1,225 lb. (providing useful load of 2,775 lb. Gross

weight of maximum gross weight), wing 200 hp, per engine is reported at 251 mph at 10,000 ft; 207 mph at 5,000 ft. Using 200 hp, per engine, speed at 10,000 ft is stated to be 347 mph, wing 240 hp at same altitude, cruise speed is 199 mph. Pages D-118 contains information in detail at about \$55,000 with radio and interior. Modification is by Charles E. Aviation, Inc., Akron, Ohio.

Safety features for stretch cases, developed by Robertson Mfg. Airlines, attaches to the aircraft floor and holds patient and stretcher by special set of seat belts slotted to cargo rings.

Beech C54A4, glide slope services, to be available early next year, features all pilot-to-pilot wing on one side of tail and all tail and adjustments on engine side for maximum maneuverability. New equipment will list for about \$1,000.

Completely inboard BGA multi-engine, AVR-200, weighs less than three pounds and features a motor, not power supply, operating from 24 v. d.c. or 115 v. a.c. Unit has positive wing locks to minimize maintenance, motor is used to require less power than any of the three market light aircraft. Housing is short 1' ATR.

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Sections in Aircraft, missiles, engines, supporting equipment, modern systems and avionics and support equipment will contain over 30,000 manufacturers' product listings. Listed Air Force, Army and Navy and Aeronautics management practices — where to go, whom to see — will be reported in comprehensive AVIATION WEEK detail. Special features will include a manufacturers' index, an all-inclusive product index and a comprehensive listing of aviation distributors. These together with many other features make the greatest possible year-long emphasis for the 1958 BUYERS' GUIDE.

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Year-round selling power and impact of 1957 Buyers' Guide advertising are shown by the over 10,000 reader inquiries received during the last six months 1957 from engineering-management, purchasing, and military people throughout the U.S. and abroad. And they still keep growing. A. J. Deitz, vice-president of manufacturing, clearly indicated by the large number of reader service cards coming from vice-presidents, purchasing agents, Senior Project Engineers, Design Engineers, draftsmen, aviators and missile engineers etc., all with the same conclusion.

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RCAF Receives First Canadair Argus

First Canadair Argus to be turned over to the Royal Canadian Air Force, the third aircraft to be accepted by Canadian Air Force officials at CFB Trenton (top left). Several aircraft, which has flown more than 221 hrs, has added some services and maintenance (above) which first engine did not have. These include static port tubes and air current, some type of de-ice system were added, VHF antenna on top of fuselage.



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Air Inlet Model B-52-A—designed for the Houston Sea Island refrigeration system used on a Chance Vought F-101 "Crested"



Glenn-Hel Model F104-A, engine and tube bundle—designed for Lockheed C-130 "Hercules"



Air Inlet Model F104-A—designed for North American's F-105 "Super Sabre"

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EQUIPMENT

Rough Field Tire Deflates in Flight

Los Angeles—Progress in the development of a low pressure pneumatic tire for aircraft operating from unpaved fields was reported to the National Aeronautics meeting of the Society of Automotive Engineers by V. Finley of Fairchild Engine and Airplane Co.

Because of its unusual use, experimental tire is designed to be deflated and collapsed in flight like a balloon but to maintain drag and aerodynamic characteristics.

The tire inflation system is also designed to bleed off some tire pressure automatically as sink rate is dropped in the landing.

The purpose of this is to maintain the product of footprint area times tire pressure approximately constant until sink rate is totally dropped, thus controlling rebound.

Operating conditions of aircraft tire footprint loading are different from those of conventional landing gear in four respects.

- While rolling resistance of conventional gear on pavements is small relative to vertical load, on unpaved fields, rolling resistance may be as much as half the vertical load.

- Rolling resistance on pavements is nearly constant regardless of speed, but on unpaved fields of low shear strength soil, rolling resistance of low pressure tires may be expected to decrease as speed increases.

- Reaction of pavement is almost totally not subject to moisture content or to the case of unsaturated soil.

- Unpaved fields are not plane surfaces, and corrugations, potholes, boulders, etc., must be expected.

Very low pressure tires should have lower rolling resistance on low shear strength soils than higher pressure tires and probably less than skis. Most objective characteristics in their ability to accommodate surface irregularities.

Weight of low pressure tires built by conventional methods would probably be prohibitive. The experimental tire is fabricated by other techniques which give tire weight equal to about one percent of wheel load for a configuration giving deflation and footprint area required.

The tire is of high tensile nylon and natural rubber. Tire cord is wound in one continuous strand over collapsible cable mould. All cords are tapered at hub or head of tire. Designers hope that maximum stress in all cord is about equal for the most severe tire deflation.



ANOTHER Fairchild development for small transports is a wide main wheel loading gear on its C-119. New gear extends to the side with wheel self cover obtained at bottom. Standard gear on plane in foreground (below) extends vertically and has wheel self cover hinged at top. Fairchild tail wheels have shown new gear as an improvement.



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for
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aircraft



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Details Revised In Wheel Mover System

New York—Finality of the concept of propelling heavy jet aircraft with wheel movers has resulted in several design changes by the designers of the concept, Consolidated Diesel Electric Corp. Some details of the system were publicly revealed (AW Oct. 7, p. 17).

Here are the latest revisions and details:

- Two hydraulically-powered wheel movers—each firm—will normally be used to move plane. Units will be attached to forward, rebound wheels of the plane's four-wheel huge main gear.
- Draining wheel movers will be installed on outboard forward wheels. Yoke between the soil and chassis movers will serve to push the power vehicle. Air hose valve to turn wheel drive will serve as brake system.
- Draining movers can be replaced with wheel power units on one drive mover as required under extreme conditions of ice or snow. Addition of two extra movers will not increase speed of plane movement in bulk, from 5 mph to 24 mph.
- Single drive-type lever can be used to control speed and direction of rotation of both wheel movers, allowing pilot to steer the plane through the snow wheel. Positive control uses two levers, one for each wheel.
- Power of wheel mover can be transmitted to plane through a set of expanding links that react against the main run of the main wheels. Power to expand the links will be taken from the power vehicle's hydraulic pump.

Plan is to try out gear on prototype installation, expanding links that on the main installation. If brakes work, production units will be standardized on their configuration. If problems arise, such as foreign matter or ice on the wheel run, making use of links unworkable, Consolidated Diesel plans to return to the gear gear. Company says that Lester Products, maker of the wheels, has agreed to cut the gear into notches with production wheels if its aircraft customers want it to.

• Wheel mover system has been approved to Lockheed Aircraft Corp. for use on its C-130 Hercules. Proposal has been transmitted to the Air Force for consideration.

Also in that when the C-130 is used in snowy areas, it may be required to land on prepared fields with the possibility of being down in heavy terrain.

To remove a plane the run and weight of even as many C-130 under such conditions could become a major operation. Consolidated Diesel engineers believe that their wheel movers, coupled to the aircraft's four main

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GREATEST TEST
400 BC

Archytas and his wooden pigeon

Mathematics and archeologists have recorded legends and mythology dealing with flight as far back as 400 B.C. However, it is not until 400 B.C. that history records the first aerial flight experiment distinctly removed from pure mythology.

Archytas, brilliant Greek philosopher, scientist, mathematician and general, is credited with constructing a wooden, self-powered flying dove. When released, this dove was believed to have flown for twenty minutes, a legend, scientific explanation is still lacking. Theories offered to explain the alleged flight have been many—a lighter-than-air wood unknown to us today, the use of a gas within the model, and even a mechanical device which may have been the basis of combustion engines. Most researchers think of Archytas' accomplishment as "possible but incredible."

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What happened to the price of oxygen?

The price of bulk oxygen has dropped about 80% in 12 years, while most other prices have risen. Oxygen is now being produced in large quantities for a few dollars per ton.

Oxygen isn't the high-priced chemical it used to be. Now, it's a low-priced teenage commodity—a utility purchased like electricity or water. The price drop is the real reason oxygen usage has climbed beyond 70 billion cubic feet per year.

Why was it costly?

Transportation costs, storage, outside labor involvements and the other limitations of outside supply added expense and uncertainty to handle-on-oxygen. Trucks and tank cars are still in use, but today's major savings result from Air Products on-lease generation.

Air Products reduced the cost

In 1940, Air Products developed oxygen generators which could be installed right in an industrial plant to meet any oxygen need, safely and economically. With generators built, operated and maintained by Air Products, industry could now have its own on-site supply of oxygen at a guaranteed price... without investing one cent of capital.

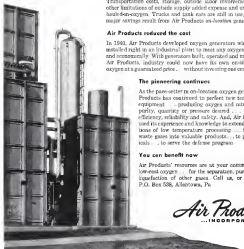
The pioneering continues

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Hundreds of Air Products pocket generators and heavy plants are now on lease... capacities range from 16 tons to 800 tons per day.

which, could ensure the plane and power it to faster speeds with a minimum of effort and cost. Automobile-type chairs could be used on the wheels to provide maximum thrust.

Can Diesel engines convert this, if much of the plane's body is also moved down, wheel motors might not be able to do the job.

Another potential customer of wheel motors is Stratton Air Command. Conventional 40,000-lb. jets prove inadequate, under current conditions, to move SAC's 40,000-lb. B-52. That requires that the tag be doubled, or even tripled up, to save the giant plane.

OFF THE LINE

Contract to do the future design, design and order scheme of the 30 Vickers Viscounts ordered by Trans-Canada Air Lines has been awarded. Charles Butler Associates, Butler has been responsible for the mission of all Vickers Viscounts being operated as an order by TCA in Canada and by Capital Air Lines and Continental Air Lines in the U.S. Butler's address: 19 E. 53rd St. New York, N.Y.

Contract to provide technical advice for several engine systems various two and four-stroke has been awarded. Brown Manufacturing Company, Pasadena, Calif. by USAP's Air Motor Company. Contract covers industrial applications with both Stirling and Vertical Air Compressors, an IBM's K-36 and K-46 Universal General Control System (UCCS) components.

National Standard Company's steel, interest in Periodic Equipment Inc. has been purchased by Bender Aviation Corporation. Periodic Equipment, Van Nuys, Calif., is a developer and manufacturer of jet engine metal cases which are used in overcoming thermal problems in high temperature hydraulic systems in planes and guided missiles. New steel case then prevents in cooling burner chamber walls and turbine buckets in jet engines to extend their operating life. Company also makes Pennwoods, a composite, stainless steel case which material which can be welded to aircraft that applications where heat and pressure are problems.

Millville, N.J.—Lighthouse College of Air Force drive many lead, driven from a large audience at the Airwork Operations Symposium with some well-chosen comments about problems of pilots from planning their flights under IFR conditions. Example: "The Washington tower will use the check-in on the 14th St. bridge—but I don't let there and haven't a clue where it is."



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Aerothermodynamic Staff members discuss heat flow during testing of a hypersonic vehicle. Left to right: J. I. Givens, aerodynamicist; R. G. Wilson, thermodynamic research; W. L. Bryant, thermodynamic analysis; Dr. E. M. Wilson, Thermodynamic Section head.



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WHAT'S NEW

Reports Available:

The following reports were sponsored by The Office of Technical Services, United States Department of Commerce, Washington 25, D. C.

Studies of Quantitative Methods for the Separation and Determination of Zinc and Thionin in Magnesium Alloy—E. A. Rabe, Wright Air Development Center, U. S. Air Force; June 1957. 51.75, 61pp., (PB 131244)

Factors Affecting the Fluidity and Hot Choking of Magnesium Alloys—J. J. Taylor and M. C. Flanagan, Jr., Massachusetts Institute of Technology for Wright Air Development Center, U. S. Air Force; Jan. 1957. 52.49, 91pp., (PB 131445)

Investigation of a New Method for the Determination of the Coefficients of Surface Diffusion of Metals—P. F. Metrick, Houston, Inc., for Air Force of Scientific Research; Sept. 1956. 51.75, 65pp., (PB 131956)

The Photoacoustic Determination of Small Amounts of Aluminum in Steel Using 5-Hydroxyquinoline—E. S. Lohr and A. J. Frank, Watertown Arsenal, U. S. Army; Nov. 1955. 51.50, 11pp., (PB 131187)

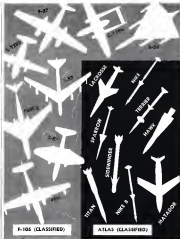
The Determination of Small Amounts of Carbon in Molybdenum and Alloy by the Conductometric Method—W. R. Shubert, Watertown Arsenal, U. S. Army; Aug. 1954. 51.50, 11 pp., (PB 131159)

Theory Design and Engineering Evaluation of Radio-Frequency Shielded Rooms—C. S. Yankin, U. S. Naval Air Development Center; Aug. 1956. 51.00, 133pp., (PB 131927)

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LETTERS

Manned Satellites

I would like to take this opportunity to congratulate Mr. & Herta on his editorial "Mende Mendeomestre" (AW Sept 9).

Now if Mr. Eskin, who has the opportunity, will continue his attack on the "clerics" in Washington and write editorially on coordinating the anti-semitic program, then I would have heard an offer on this subject.

It is the present ridiculous state of affairs, which is giving the American people the "phony" prosperity and absolute no aid defense. All the armed nations should have gone into a coordinated program for the establishment of armed neutrality, a far more defense.

Should we be better in the development of mutual conflict by Russia we can thank the long patience, growth and strength. Now has there been such an amount of stupidity in Washington as there is today. We need a coordinated program and less ignorant statements from Washington. D. C.

EDWARD H. TRIMBO
West Methodist Church

In Agreement

In reference to "Cockpit Viewpoint" (AMF Sept. 5, p. 51), a comment by Capt. R. C. Johnson and the several manufacturers of Automobile Direction Finders who have composed the letter to AIRCEN's "three leads to do the job of one" concept.

For an armed committee, it's hard to consider the crew a part of long armed uprisings of reaching in all directions at once and looking somewhere else while "keeping the best right side up." They, obviously, have never "passed Shredding." Pt. at 30,000 ft and landed at LaCrosse 11 minutes later. —At least not in the past 10 years. *ALAN M. BRONSTEIN*

Closed Ranks, Yacht

A Bet for Rohson

I would like to make several comments on Capt. Robinson's observations in the Sept. 9 "Cockpit Viewpoint." Capt. Robinson pointed out that the new ADF meters, usually in tandem, add complexity to cockpit procedures at a time when it is all important to reduce such complexity.

We compare between the Bandwidth DPA70 (our mainline) for the new ADFI and our previous work QAT. QAT uses all of the pilot tones from ADFI—usually, complete the time-frequency null estimation of cochannel interferers. The control tones for the new ADFI, as specified by Amendment 68A, can be used for digital frequency selection. Digital frequency selection is the technique where the frequency receiver is a method of extracting useful data communications from. Present day VSB equipment is tuned by digital means and this new ADFI offers the same advantages over the old system as the present analog VSB receivers offer over noncoherently tuned VSB receivers.

Also, digital imaging offers much greater legibility, for 95% high numbers of our (DPA 70 Canon) find are probably more

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available than any other indicator as the output.

Another important feature found in the new ADF server is the elimination of the hard switch—handwashing occurs automatically as frequency is selected.

Capt. Richison also indicated that it would also happen to have the new ADP than the old "reflex prober." This was seen to be the case on first reflections but, actually, the reverse is true. We ran a few checks on a Remco MN-61 (the old standard before ADP) and the new DFA-70, both mounted in air-dry. The average base for a pilot to have from station to station in the area, normal usage based was 3.7 in terms of the DFA-70.

Also, the "repeatability" of the DFA 70 is extremely good; in no personal experience I have found it completely adequate to set the dial to the published frequency in the astronomical band—fine-tuning is not necessary.

In conclusion, I would like to offer Capt Kubson a slight demonstration of the DFV. To ADP as my terminal area of his choice and I would like to let him a strike down that he changes his opinion about the ADP after seeing it. How about it, Capt?

Fernando S. Ponce
Superior, Executive, American Sales
Brooklyn Radio Division
Brooklyn, New York Corp
Baltimore, Md

Disgustion Cure

Replying to the letter "Wasting Time 10N" from Disputed Engineers on the July 1 issue p. 154—it seems to me that if a man spent more time concentrating on what should be done rather than what is actually done he would be less disgruntled and better off.

E. M. W.
 Buffalo, N. Y.

Cooperation Urged

For quite some time I've felt a growing sense—changing awe to resentment—over the lack of understanding and cooperation between pilots and ATIS controllers. That feeling was heightened by the Spirit accident—particularly with the subsequent CAA and CAA comment.

I am not an autism idiot—though I sure was. It is not my intention to defend Special as mad as hell. But I was very concerned over the failure of ATC to render the participants in the resident such protection as was legally available.

On many occasions I've visited ATC centers and towers—and I know they do have these problems. But in silence as well.

these problems could be considerably lightened by accepting and even inviting price competition. This is a relatively rare school, especially in the Southwest. Sometimes the reading consultants' attitudes perpetuate—and then create—these issues.

[illegible]

Overseas Chapter
East Hill Airport
Hempstead, N. Y.

He's Right

On p. 11 of the Sept. 9 issue, *Artemus*, *Wren*, identified a B-60 entering two F-70s and a B-54. I would like to see that your identification of the B-54 was wrong. It is a B-65.

Devon Haxton,
Hollywood, Calif

Pilot Backs Speech

I read with great interest your parents' tale of the feelings and rebirth of the Spycht (see *AW* March 11, p. 10). Having experienced the dissonance associated with such events myself, more than once, I share my lot with Spycht.

The overriding point of this matter is made best among all the words, both written and spoken, that are associated with the second growing that will always come. The point is, what is in command of us in place in light the pilot is someone, are we, etc? The answer is obvious.

If a pilot shows his emergency powers he should be observed permanently, provided his conduct is established by facts.

rate means. However, the burden of proof is never on him, and in case of reasonable doubt, schools are assigned a neutral or qualified to pass judgment. And at the moment the assessor is declared not a solitary soul can promise to give less than considerate, full constructive response with every means at hand, regardless of personal feelings, even colleagues, etc.

I have the greatest respect and admiration for ground-control personnel, and I cooperate with them to the fullest. But the guy who's driving the bus is the guy with the wheel in his little hot hands never anyone else. To question that is folly.

Curt William F. Meene, USAF
Wright-Patterson AFB, Ohio

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